a. *b.*

DELAWARE GRAPES.

a. Four average bagged clusters: *b*. Three unbagged clusters (see page 30).

PHILODENDRON PERTUSUM.

In the main green house.

MISSOURI

BOTANICAL GARDEN.

SECOND ANNUAL REPORT.

ST. LOUIS, MO.:
PUBLISHED BY THE BOARD OF TRUSTEES.
1891.

BOARD OF TRUSTEES OF THE MISSOURI BOTANICAL GARDEN.

President,
RUFUS J. LACKLAND.

Vice-President,
HENRY HITCHCOCK, LL. D.

JOSEPH W. BRANCH.

GEORGE S. DRAKE.[1]

GEORGE J. ENGELMANN, M. D.[2]

JOHN B. JOHNSON, M. D.

DAVID F. KAIME.

GEORGE A. MADILL.

WILLIAM H. H. PETTUS.

JAMES E. YEATMAN.

CHARLES F. MILLER,[3]
President of the Board of Public Schools of St. Louis.*

FRANCIS E. NIPHER,
President of the Academy of Science of St. Louis.*

EDWARD A. NOONAN,
Mayor of the City of St. Louis.*

DANIEL S. TUTTLE,
Bishop of the Diocese of Missouri.*

_____,
Chancellor of Washington University.*

A. D. CUNNINGHAM, Secretary.

---

* *Ex-officio.*

[1] Elected April 9th, 1890, to fill the vacancy caused by the resignation of Judge Samuel Treat, one of the Trustees named by Mr. Shaw.

[2] Elected December 18th, 1889, to fill the vacancy caused by the resignation of M. Dwight Collier, one of the Trustees named by Mr. Shaw, but who had removed from the city.

[3] Elected President of the School Board November 12th, 1889, in place of F. N. Judson, who met with the Board until that date; succeeded by Dr. Hugo Auler from March 11th to May 20th, 1890, at which time he was re-elected and has since met with the Board.

PREFACE.

The Board of Trustees of the Missouri Botanical Garden have instructed the Director to edit for publication each year a volume setting forth the objects of the Botanical Garden and the School of Botany, and the results accomplished by each; and summarizing the receipts and expenditures of the Board.

The first volume of this series was prepared in the summer of 1890, and issued in the following December. Although it contained reports up to the date of its publication, this was primarily intended to be an account of the establishment of the Garden and School of Botany. The present volume, therefore, really begins the series of annual reports, and should properly contain the first annual flower sermon and the report of the proceedings at the first annual banquet given by the Board under the provisions of the will of Mr. Shaw, both of which appear in the preceding volume. Owing to the small portion of 1889 during which the Board existed, no financial report for that year was made, so that the report of the officers, now published, covers the period from the organization of the Board to the end of the year 1890.

WILLIAM TRELEASE.

ST. LOUIS, Jan. 17, 1891.

CONTENTS.

PAGE.

1. REPORTS FOR THE YEAR 1890: —

   a. Report of the Officers of the Board 7

   b. Second Annual Report of the Director 13

2. ANNIVERSARY PUBLICATIONS: —

   a. Proceedings at the first annual banquet to Gardeners . . 35

3. SCIENTIFIC PAPERS: —

   a. Revision of North American species of Epilobium — *By William Trelease* 69

REPORTS FOR THE YEAR 1890.

REPORT OF THE OFFICERS OF THE BOARD.

SUBMITTED TO THE TRUSTEES JAN. 14, 1891.

To the Board of Trustees of the Missouri Botanical Garden:

In compliance with the resolution of the Board directing an annual statement or report to be prepared by the President and Secretary for publication, showing the management and financial condition of the trust, the following statement is submitted, covering the entire period since the organization of the Board up to December 31, 1890.

By an act of the General Assembly of the State of Missouri, approved March 14, 1859, the late Henry Shaw was authorized and empowered to convey certain real estate and personal property to trustees for the purpose of establishing and maintaining a botanical garden; and by his will, dated Jan. 26, 1885, certain real and personal property was bequeathed to trustees named therein "for the object and with the view of having for the use of the public a botanical garden, easily accessible, which should be forever kept up and maintained for the cultivation and propagation of plants, flowers, fruit and forest trees, and other productions of the vegetable kingdom; and a museum and library connected therewith, and devoted to the same and to the science of botany, horticulture and allied objects."

Mr. Shaw departed this life Aug. 25, 1889, and on Sept. 10, 1889, seven of the trustees named in the will met for consultation.

The Board of Trustees of the Missouri Botanical Garden was duly organized Oct. 14, 1889 by a majority of the

trustees living at the time of Mr. Shaw's death, and immediately entered into possession of the real estate and the personal property contained in his town residence and the garden, not otherwise bequeathed, and have collected and disbursed the revenue from the same since Sept. 1, 1889.

In order to have a basis for the valuation of the real estate bequeathed to them under the will of Mr. Shaw, the Board caused a set of books to be opened by its Secretary, charging the real estate account with each piece of property at its assessed value and crediting this amount to stock account, thus showing a valuation of $1,241,274.00, which property is held for revenue purposes.

In addition to this, the Missouri Botanical Garden was charged with that portion of the estate known as Shaw's Garden, including the Arboretum and Fruticetum and also the farm surrounding it on the south and west, at its assessed valuation of $123,160.00, and the stock account was credited with a like amount, making the total assessed value of the real estate which came into possession of the Board $1,366,334.00.

This does not include any of the personal property yet in the hands of the Public Administrator; but comparatively little can be realized from this source, as most of it will be absorbed in paying legacies, and the state, school and city taxes for the years 1889 and 1890.

Much of the property was in very bad repair, and some of it vacant for that reason, but by a liberal but judicious expenditure it has been placed in reasonably good condition and was promptly occupied by profitable and desirable tenants.

A large amount has been expended upon the Garden for labor, repairs and improvements, the reasons for which fully appear from the Director's annual report. Referring for the amounts so expended to the cash statement herewith, and to the Director's report for details, the following may be briefly stated here: —

About forty men have been constantly employed in and

about the Garden, Arboretum and Fruticetum, at an average aggregate cost for labor of $1,135.00 per month, including wages of the head gardener and three foremen.

It was found absolutely necessary for their preservation to repair extensively the improvements at the Garden, including the heavy stone wall surrounding it, more than 4,000 feet long, and averaging ten feet in height; the stone gateway on Tower Grove avenue, and the plant houses and other structures; also to improve and extend the drainage of the gravel walks and other portions of the grounds, and to replace almost entirely the brick edging of the flower beds. An inspection of the stone wall, erected more than twenty years ago, disclosed serious and increasing injury from frost, making it necessary to repoint with cement the entire surface of more than 1,300 linear feet, besides resetting almost the entire coping. The stone work of the main gateway, built in 1859, part of which was cracked and unsafe from like causes, has been repaired and strengthened. Decaying woodwork and crumbling brick and stonework in the plant houses also required replacing to a much greater extent than appeared on a casual examination. It was also necessary to extend, in fact almost entirely to renew, the imperfect drainage of the gravel walks, especially in the neighborhood of the museum and the residence, and to begin the proper drainage of the Fruticetum, for which purpose some 4,200 feet of drain tiles have been laid in all; to entirely replace more than three miles of brick edging of the flower beds which had become dilapidated and unsightly; and to rebuild about 4,650 feet of fencing on the Garden and neighboring property, too badly decayed to be repaired, besides repairing as much more.

The supply of water heretofore exclusively obtained, both for garden and residence purposes, from wells and cisterns at the Garden, proved in part unsafe for use and altogether insufficient during the exceptional drought of last summer. The only remedy for this was to make a connec-

tion with the city main on Magnolia avenue, which was done at a first cost of some $2,300.00.

Very soon after the Director occupied the residence at the Garden assigned to him by Mr. Shaw's will, serious sickness in his family induced the Board to cause a competent inspection of the sanitary condition of the building. It was found so unsafe, as the result of very defective drainage for many years past, that a difficult problem was presented, the only solution of which was found to be to rebuild the eastern wing of the dwelling and to provide proper sewerage for the entire building. The house occupied by the head gardener, on the Manchester road, was also found to require considerable repairs and suitable provision for drainage.

Besides these unavoidable expenditures for the preservation of the property, the increase of the library and the proper mounting of the very valuable Engelmann Herbarium, both expressly provided for in the will of Mr. Shaw, involved a considerable outlay, as shown by the annexed statement. As further provided in the will, and in pursuance of separate memoranda left by Mr. Shaw as suggestions for the Trustees, six scholarships for "Garden Pupils" were established by the Board, early in 1890, for practical and theoretical education in horticulture, to be filled by competitive examination. Four such pupils are now employed at the Garden, the building on Tower Grove and Magnolia avenues, formerly known as the Casino, being occupied by them and other employees. Public notice has been given by the Director of the two scholarships now vacant, and competition invited for them in March next.

Reference must be made to the very full and interesting report of the Director for the past year, to be published in the annual volume for 1891, for many other details of the management of the Garden, including the steps taken for the greater accommodation of visitors, the prohibition of fees formerly paid by persons leaving vehicles at the gate,

the care and cultivation of the Garden, and the improvement of the grounds.

In all these respects the Director has intelligently and faithfully sought to carry out the desire of Mr. Shaw that the attractive and ornamental features of the Garden should be maintained and increased. His efforts to that end have been aided by the suggestions of the Garden Committee, who have regularly devoted one afternoon of each month to an inspection of the Garden and grounds and conference with the Director, and have been supported by the cordial co-operation of the Board.

The cash receipts and expenditures since the Board have been in possession of the property, for sixteen months from Sept. 1, 1889, to Dec. 31, 1890, have been as follows: —

RECEIPTS.

Rents from stores, dwellings and lands	$119,323 96
Other sources	1,517 97
Total receipts	$120,841 93

EXPENDITURES.

Office of the Board —		
Salaries, Secretary	$2,587 36	
Stationery, printing, etc	1,643 99	
Janitor	420 00	4,651 35
Garden account —		
Labor	18,207 48	
Fuel	1,099 94	
Stable, feed, etc	578 50	
Repairs and supplies	8,420 15	
Lodge and garden pupils	2,467 06	
Bulbs, seeds, plants, etc	622 29	
Herbarium, Specimens and mounting	5,208 91	
Library, Books and subscriptions	5,532 38	
Office, Director, assistants, etc	6,932 47	49,069 18
Improvements, Water pipe and attachments	2,334 01	
Director's residence and repairs	7,471 17	9,805 18
Property for revenue purposes —		
Streets, Pavements and sewers	1,052 54	
Improvements	1,075 00	
Sprinkling tax	447 07	
Insurance, average 3 years, renewals	7,962 45	
Repairs	10,549 48	
Commissions, for collection of rents	4,263 85	25,350 39
Forward		88,876 10

Forward		$88,876 10
General Account —		
Washington University, School of Botany	$3,500 00	
Legal expense, F. N. Judson	1,144 90	
Annual Flower Sermon	200 00	
Trustees' Annual Banquet	1,063 25	
Gardeners' Annual Banquet	358 80	
Publications	1,493 65	$7,760 60
Total expenditures		96,636 70
Balance in bank and office		24,205 23
		$120.841 93

Financial condition, Dec. 31, 1890 —		
Cash on hand and in bank	24,205 23	
Uncollected rents due Dec. 31, 1890	7,349 50	31,554 73
Less amount due capital stock account for sale of horses and other stock		504 00
Balance		$31,050 73

The books of the Board have been closed after showing the operations for the sixteen months ending Dec. 31, 1890, and the receipts have been disposed of as follows: —

Rent account, including rents due to January 1, 1891, in course of collection, $7,349.50	$126,673 46

CONTRA.

Garden expenses		$48,617 22
Office expenses		4,651 35
Commissions		4,263 85
Repairs		9,986 98
Insurance		7,962 45
Taxes, Sprinkling		447 07
Streets, Pavements and sewers		1,052 54
Washington University		3,500 00
New improvements		10,880 18
Legal expenses		1,144 90
Flower Sermon		200 00
Trustees' Annual Banquet		1,063 25
Gardeners' " "		358 80
Publications		1,493 65
Fire losses in excess of repairs for same		49
		$95,622 73
Balance, surplus for 1889 and 1890	31,050 73	
	$126,673 46	$126,673 46

Respectfully submitted,

R. J. LACKLAND, *President.*

Attest,

A. D. CUNNINGHAM, *Secretary.*

SECOND ANNUAL REPORT OF THE DIRECTOR, FOR 1890.

SUBMITTED TO THE TRUSTEES JAN. 14, 1891.

To the Board of Trustees of the Missouri Botanical Garden:

In accordance with the rules and regulations of the Board, I respectfully submit the following report on the condition and prospects of the Botanical Garden, and of the School of Botany therewith connected.

THE BOTANICAL GARDEN.

By resolution of the Board of Trustees, the Director of the Garden is instructed: —

1. To continue or even augment the present ornamental features of the Garden.

2. To add to its botanical usefulness and interest by the introduction, as opportunity offers, of plants representative of the American flora, so that, other things being equal, these shall ultimately be largely represented and may even preponderate outside of the greenhouses, giving then, in the Garden, an epitome of the leading characteristics of our native flora.

3. To carry into execution, as rapidly as possible, a system of correctly naming and labeling all plants in the Garden, with the exception of such as may be used in ribbon gardening or for other exclusively ornamental purposes.

4. To provide fire-proof quarters for the invaluable herbarium of the late Dr. George Engelmann, and to immediately mount it in the proper manner, so as to insure its preservation and availability for scientific use. Also, to provide for and add to the general herbarium (based on that of Bernhardi) now at the Garden, with the special object of ultimately making it complete in good representatives of American plants.

5. To arrange, bind, and index the books and pamphlets at the Garden. Also, to provide more ample but equally safe accommodations for the library, to bring it up to date as rapidly as possible, to enter subscriptions for periodical publications, and to keep it abreast of the times, and in the most useful form, by the purchase of important publications as they shall appear, and by the proper indexing of periodicals and pamphlets.

6. To secure a botanical museum, containing material needed for study or calculated to advance general or special knowledge of botany.

7. To direct the main energy of research for the present toward assist-

ing in the completion of a systematic account of the flowering plants of North America, by the publication of monographs of different Orders and Genera, illustrated when this may seem desirable; and to specially cultivate representatives of such groups for purposes of study.

8. To gradually acquire and utilize facilities for research in vegetable histology and physiology, the diseases and injuries of plants, and other branches of botany and horticulture, as special reason for developing one or the other may appear.

9. To make the facilities of the Garden useful in botanical and horticultural instruction, as they increase and opportunity for such work appears: meantime, in all feasible ways, to attract to the School of Botany students of promise, and to provide for their instruction and the best use of their time as investigators.

10. To take steps looking to the early appointment of six 'garden pupils,' — youths with at least an elementary English education, who shall be regarded as apprentices in the Garden, working under the direction of the head gardener and foremen, and shall hold scholarships yielding $300.00 per year each, together with free lodging near or in the Garden, and free tuition in the School of Botany; and who, after having worked for six or more years (as shall ultimately prove best) in the different departments of the Garden, and proved proficient in its practical work, may be admitted to examination for a certificate of proficiency in the theory and practice of gardening.

11. To have in mind, in appointing associates for the Director, their special aptitude in some one of the branches indicated above, so that with each appointment the efficiency of the institution for instruction and original work may be broadened and increased.

During the past year, efforts have been made to advance he establishment in all of the directions indicated; but particular attention has been given to steps calculated to make the Garden attractive and instructive to visitors, and to make possible the performance there of substantial and useful botanical work.

The following rules, essentially the same as those in force during the life-time of Mr. Shaw, are posted at the gate, and, as a general thing, are cheerfully complied with: —

The Garden is open to the public free of charge daily (holidays excepted) from 8 a. m. until half an hour after sunset. It is closed on Sunday, excepting the first Sunday each in June and September, when it is open from 2 p. m. until sunset.

The offices, herbarium, library, and private greenhouses, are open only to authorized students, or persons having business with the Director or Head Gardener.

Lunches, baskets, satchels, and parcels of every description, must be left outside. If small, they may be cared for by the Gate-keeper, who will make no charge for her services.

Visitors are particularly requested not to handle specimens, nor to pick flowers, fruit, or leaves, or in any way mutilate or deface any plants or other property in or about the grounds.

Intoxicated or disorderly persons will be refused admittance.

Smoking is not allowed.

Any infringement of these regulations, or any discourtesy on the part of employees of the garden, should be at once reported to the Director.

In addition to removing the fee formerly charged at the gate for the care of parcels, a competent person has been engaged to indicate hitching places for carriages not in the care of drivers, and to exercise a general supervision about the gate, without charging visitors for such assistance. This step has entirely removed a cause of frequent complaint when fees were permitted. All employees of the Garden are forbidden to ask fees for any service rendered visitors, and are instructed to refuse gratuities if these are offered. In October, while many strangers are in the city, attracted by the St. Louis Fair, many more people visit the Garden than at other times. It has for years proved impracticable at this season to prevent men and boys from congregating about the gate and offering their services to visitors who wish their carriages watched while they are in the Garden. Such persons can not well be prevented from receiving or even asking compensation for their services; but the police have co-operated with me in protecting visitors from annoyance by them.

So far as can be ascertained without the employment of automatic registers at the gate, the number of visitors to the Garden during 1890 has been about equal to that in past years. On the two Sundays when the grounds were open to the public, they were thronged by an unusually large number of people. In June, particularly, they were crowded during the entire afternoon, a moderate estimate placing the number of visitors at 20,000. In September, owing to frequent and heavy showers, the number was

much smaller, being estimated at about 3,000 persons. On both of these occasions the class of visitors was quite different from that seen on working days, owing to the fact that many people are unable to visit the Garden except on these Sundays; but very few persons of questionable appearance were noticed, the visitors were quiet and orderly, and practically no disposition to violate the rules was noticed.

As I predicted in my last report, much work has proved necessary in placing the Garden in suitable repair. This has been very largely a work of reconstruction, nearly all of the woodwork which needed repairing being almost totally decayed except for a surface film protected by paint, so that on attempting to replace any portion that had given way it was found necessary to tear down the abutting parts, their removal in turn necessitating that of still others. Even the softer brick and the limestone prove to be in much the same condition, and in many places the mortar or cement in which they were laid has become completely disintegrated. Consequently, the hope that I expressed a year since that the Garden might soon be in a fair state of repair is as yet far from realized, although this work has been carried forward with as great rapidity as the finances of the Board permitted, and I am informed that more work of this character has been done during the past year than for at least ten years preceding.

Without going into the minutiæ of these repairs, I mention among the more important of the steps taken, the following: —

The limestone coping over the Gate House has for some years been badly cracked in many places, and the action of dampness and frost has so far opened the crevices and joints that early in the season it was considered unsafe to allow the stone to remain longer in this fragmentary condition, owing to the probability that large overhanging pieces might at any moment fall, endangering the life of persons passing through the gateway, — one such piece having, in fact, fallen several years since. On examination it

appeared that the lintels and even the supporting columns were almost as badly disintegrated and broken, although supported by their mutual position in such a manner that they were safe as long as their equilibrium was undisturbed. The removal of the coping for reconstruction was almost certain to destroy this, in that event necessitating the practical rebuilding of the entire gateway; consequently, the coping was not removed, but was firmly bound with straps of wrought iron, and the whole was closely encased in a metallic sheath, the fissures in the remaining stonework then being suitably filled and the entire surface painted to give uniformity of appearance and prevent further decay. The gateway has been further improved by laying granitoid within the passage-way in place of the original rough stone pavement; and the ladies' waiting room has been renovated and made as convenient and sanitary as was possible in the absence of a sewerage system.

The gravel walks of the Garden, which, owing to the thin layer of rock used in their construction and the undrained character of the soil, have always become soft and almost impassable in winter, are being remade with a better macadam foundation and suitable underdrainage, the unsightly and inconvenient gutters which cross them at intervals to carry off surface water being rendered less necessary by more frequent communication with the drains. Some 1,700 lineal feet of walk have been thus made during the past year, the grades being modified in places where this was necessary. Very much of this work, however, still remains to be done; and it will require some time to so compact the newly made walks by rolling as to make them, — what properly made and cared for gravel walks are, — a most agreeable surface to walk on, as well as the only walks appropriate to a garden.

The limits between walks and the adjoining turf or flower-borders throughout the Garden are marked by lines of sunken brick. So badly have these suffered from frost and the wear of many years, that they had become very un-

sightly, in many places the bricks being in fragments and nearly out of the ground. During the summer this edging has been replaced with the best quality of pressed brick, to the extent of some 18,500 lineal feet,—something over three miles. About 10,000 square feet of sod has been removed along these walks and elsewhere, and relaid after grading the ground.

Including the drains under walks that have been remade, and a subterranean drain in place of the open brick trench which formerly surrounded the parterre, some 4,200 running feet of drain has been laid. 1,550 feet of this is in a portion of the Fruticetum, preparatory to a partially completed double-spading of the ground as a means of fitting it for experimental planting. Some of the old stone and brick sewers have also been opened, and the earth with which they have for years been obstructed has been removed. But this merely forms a beginning to what must be done in this direction; for many parts of the Garden are still undrained, little of the soil is sufficiently drained, and it is so long since some of the old drains have been examined that the oldest employees cannot tell where over half of them begin nor what their course is, and the channels in many cases are entirely obliterated.

The main greenhouse, facing the parterre, proves sadly in need of repairs. During the summer a pit was sunken in the central portion, to allow a fine palm to be lowered, as it was crowded against the glass of the roof. The east wing of this house, so badly decayed as not to admit of other treatment, was removed to the foundation on three sides and durably rebuilt. It will also soon be necessary to rebuild the west wing of the same house. The small plant house in the northeast corner of the vegetable garden (interesting as being the oldest greenhouse on the grounds, having been built by Mr. Shaw when the Garden was limited to the area immediately in the rear of the residence, but which has for years been unsuited to actual use) has also been reroofed and provided with suitable staging, for

use in vegetable gardening aud experimental work, the exterior being left essentially unchanged. This renovation of the plant houses must be continued during the coming year. As such work is done, the wooden supports for plants are being gradually replaced by iron and slate, as far as practicable.

So badly decayed is the cement in which the massive wall about a portion of the grounds is laid, that in many places the structure stands almost entirely because of the direct contact of the rough stones one with another, and sparrows have for several years nested in the interior of some parts of the wall. It was obviously necessary to take steps at the earliest possible moment to stop further weathering and thus prevent the dislocation and falling of stones and the consequent destruction of the wall. Some 1,300 lineal feet of the wall has, therefore, been thoroughly cleaned so far as the surface joints are concerned, and both sides have been well pointed with mortar tempered with the best Portland cement. In addition to this, the coping of the remainder of the main wall, — some 1,900 running feet, — has been similarly repointed.

The remaining surface of this wall, as well as the one which separates the Garden proper from the Arboretum, will ultimately require similar treatment; but these parts are in no immediate danger. In connection with this, it may be said that about 2,500 feet of plank fence has been entirely rebuilt, 4,000 feet of similar fence repaired, 200 feet of close board fence built, 115 feet of paneled wire fence set, 650 feet of picket fence repaired, and 1,840 feet of picket fence entirely rebuilt.

There are obvious reasons why parts of the grounds on which fruits are grown, or which are devoted to experiments, cannot be opened to the general public. The Fruticetum is of this nature, and, except during a brief season each year, was kept closed by Mr. Shaw. This inclosure, and the vegetable garden and private grounds at the rear of the residence, from being so closed have come

in time to receive very little attention, so that much reconstructive work must be done to put them in proper condition for even casual inspection. Reference has already been made to draining and subsoiling about one-fourth of the Fruticetum, which will be planted as a nursery. It is proposed in due time to improve the remainder of this tract, and the vegetable garden, in the same manner, and with this work will come a gradual renovation of the neglected walks, fences and trellises, so that those parts of the Garden which are closed to the public will be as neatly cared for ultimately as those that are open; but this is obviously of less immediate importance than bringing the latter into proper condition.

While it is open to the public, the Arboretum likewise has received in the past less care than the Garden proper, and, as it is entirely undrained and much too closely planted, it has for some years been rendered unsightly by the accumulation of dead and dying trees and branches which have increased more rapidly than they could be removed. During the last winter men were constantly employed in the removal of this dead wood, and this work has been continued the present season, so that it is now nearly completed. The planting of this inclosure, as I have stated, is altogether too crowded for the good of the trees, and, being in straight rows, renders the production of good landscape effects difficult. But as time goes on, a proper system of drainage will render many of the trees more thrifty; and by the removal of trees at suitable points the others will be given a better opportunity for development, and the landscape effect considerably improved. It is not proposed, however, nor was it ever Mr. Shaw's intention, to give the Arboretum the polished appearance of an English garden; and a considerable amount of wildness and seeming neglect will probably always be maintained here, as refreshing to visitors who have walked through the Garden and wish to get into the woods, and as a means of preserving in their natural surroundings some few of the wild flowers of the region.

GRAPE ARBOR IN THE FRUTICETUM.

Here, as elsewhere, repairs necessitate in the main reconstruction, and I have been obliged to rebuild the bridges over the little brook that runs through the place. Suitable toilet arrangements, in the absence of any system of sewerage, are next to impossible; but by erecting in the Arboretum two of the iron structures designed by the J. L. Mott Iron Works for park use, in place of the more dilapidated of the frame structures formerly located there, and equipping them as earth closets, the grounds have been made rather less repugnant and far more sanitary and convenient in this respect. For many years a compost pile has been maintained in the Arboretum, because of the convenience of this location to the plant houses and Garden. Provision for this necessary adjunct of a garden has now been made at the stable, so that it will soon be removed to a less conspicuous place.

The unusual drought of this year showed the necessity of a step considered by the Board a year since, — that of providing the Garden with a supply of city water. No action was taken at that time because it was found on inquiry that the Garden had suffered but once in the last twenty-five years from a deficient water supply. But so serious was the damage done by the exceptional drought this year, and so pressing the necessity for a surer and safer supply of drinking water, that action could no longer be delayed. The institution was therefore connected with the city main on Magnolia avenue by laying some 2,000 feet of 6-inch pipe on Tower Grove avenue, and carrying two 3-inch mains into the Garden, these measuring about 650 feet, and serving merely to carry water to a few points from which it can be distributed by hose, a more thorough system of carrying it through the grounds in pipes remaining for future adoption.

Two wells, notoriously unsanitary, have been closed during the year, one of them being filled to the surface. Analyses were made of the water of six other wells from which the public have been accustomed to drink, and show

that, although unusually hard and somewhat suspiciously high in the amount of albuminoids and chlorides contained, the water from these wells is apparently safe so far as present sewage or surface contamination is concerned. But it was shown that from the backing up of water in the sewer during heavy rains, the cistern that has furnished water for the Director's residence is entirely unfit for use. The wells which have been pronounced safe, will, as in the past, be kept open, since they afford much cooler water during the summer than is obtainable from the city water supply; but early in the coming season it is proposed to place a small drinking fountain on the main near the gate-house, for the convenience of persons who wish to obtain water on leaving the Garden.

Imperfect drainage, and the close proximity of cesspools and vaults, have made it necessary during the year to granitoid the cellars of the gate house, the farm house, and the dwelling of the Head Gardener. Each of these buildings has also received other repairs, so that all have been rendered much more comfortable and healthful. Early in the season the attention of the Board was drawn to the obviously unsanitary condition of the late residence of Mr. Shaw, now assigned to the Director of the Garden in accordance with Mr. Shaw's wishes. It is known that for many years inmates of the house have been subject to fevers, and an examination of the premises by several physicians showed that the entire surroundings were so unsanitary that nothing but radical measures could make the building at all safe. It was, therefore, decided to carry city water to the house, lay a new sewer and cut off all connection with the old one, — a loosely laid stone drain clogged by the filth of many years, — and remove and rebuild the east wing of the house, which was especially unsafe, and at the same time not in keeping with the remainder of the building. This work of renovation has apparently been thoroughly done, and is now substantially completed. The unsightly ice house east of the dwelling was removed

at the same time, and this part of the lawn will be properly graded and sodded as soon as the new soil has had time to become well settled.

While this work was under way, a steam outfit was placed under one end of the small greenhouse in the vegetable garden, already referred to, from which pipes were laid for the purpose of heating the residence and museum, thus relieving both buildings from much dirt, and materially lessening danger from fire, — a matter of particular importance so long as the library and herbarium are located in the latter building. The location of the boilers is also such that when a new building shall be provided for the herbarium and library, it can probably be conveniently and economically heated from the same point by enlarging the pit and setting an additional boiler, thus confining all dirt and danger from fire to a single isolated point.

The southern location and consequent warm average temperature of St. Louis are in many respects favorable to horticultural pursuits. But the frequent extreme cold of a portion of the winter and the dry air and occasionally severe drought of summer, as well as the peculiarly heavy nature of the soil where the Garden is located, render the task of making it a representative garden unusually difficult. Trees which thrive in England, and even so far north as Denmark, are occasionally destroyed by a single severe winter here. This is notably true of the Sequoias and other Californian evergreens. Even the Magnolia, which endures the coast climate as far north as Philadelphia, can be grown in the Garden only as a shrub, bent down and covered during the winter; and Paulownia, which apparently does as well in Brooklyn as the Catalpa, is usually killed back during the winter in St. Louis, so as rarely to flower. After some forty years of existence, the Garden is still weak in native herbaceous plants. It need, therefore, excite little surprise that few permanent additions have been made to the grounds during the past year. Before this can be

done, thorough drainage and other preparation of the soil is necessary. Such work, however, is being done gradually, and plans are now under consideration as a result of which some progress in this direction may be hoped for within a short time; meantime, the variety of plants cultivated in the open air is being somewhat increased. Various additions have been made to the greenhouse collections, — among other things a considerable number of Cacti having been added to the already fair number in cultivation.

Some difficulty has been encountered in procuring suitable labels for the trees and other plants, but names have been temporarily affixed to many which were before without names, and experiments are being made, as a result of which it is hoped that within a comparatively short time no plant on the grounds will be without a legible and durable label indicating its name and habitat.

Work on the Engelmann herbarium has progressed so far that this collection is now essentially mounted in the usual manner, and it is probable that by early summer the work will have been completed and all of the specimens properly arranged in suitable hard wood cases that have been placed in the museum, awaiting the provision of a separate fire-proof building for the herbarium and library. Except for the cases and other furniture which it contains, the building in which the specimens are thus temporarily placed is a fire-proof structure. As has been indicated in the Garden volume for 1890 (pp. 87-90), a very considerable addition has been made to the general herbarium by donations from the School of Botany; and numerous specimens have been received from the Secretary of Agriculture, Mrs. Katherine Brandegee, Dr. D. V. Deane, Professor John Macoun, Mr. T. V. Munson, and other correspondents, to whom the thanks of the institution are cordially tendered. Between 2,000 and 3,000 additional specimens have been acquired by purchase, and for the most part have been mounted as received. Work has also

been begun on the Bernhardi herbarium,* which will be mounted in the same manner as the other collections already referred to.

The library has received constant additions during the year, some $6,000.00 having been expended for the purchase of books, while numerous correspondents have made donations, — mainly of pamphlets. Among the donors should be mentioned especially the officers of several Government Bureaus and of many of the Agricultural Experiment Stations, whose publications are regularly received. As the publications from the Garden come to possess more botanical and horticultural value, they will doubtless prove the means of increasing the library considerably by way of exchange. Thus far, little attention has been paid to the purchase of recent works, the available funds having been mainly used in securing the rarer old books, and complete sets of necessary serials. About $400.00 additional has been expended for subscriptions to current periodicals.

Until a new building is erected for the reception of the library and herbarium, and for office purposes, no attempt can be made to form a museum, and the specimens collected by Mr. Shaw for this purpose have suffered to such an extent as to be for the most part worthless, owing to the ravages of insects and the accumulation of dust during many years. But when the formation of a new collection becomes possible, it will prove one of the most interesting and instructive adjuncts of the Garden.

In my last report, mention was made of provisions for appointing six garden pupils on scholarships. Five of these scholarships were awarded in March last, on the results of examinations. One was subsequently resigned by Mr. J. W. Dunford, who has been appointed an Assistant Gar-

---

* Purchased for the Garden in 1858 by the late Dr. Engelmann, and stated to contain about 40,000 specimens. — Engelmann in Trans. St. Louis Academy, i. p. 316.

dener. In November, 1890, the following second announcement was issued:—

In accordance with the intention of its honored Founder, the Trustees of the Garden propose to provide adequate theoretical and practical instruction for young men desirous of becoming gardeners. It is not intended at present that many persons shall be trained at the same time, nor that the instruction so planned shall duplicate the excellent courses in agriculture now offered by the numerous State Colleges of the country, but that it shall be quite distinct and limited to what is thought to be necessary for training practical gardeners.

To this end, the following resolution was adopted by the Trustees, at a meeting held on the 19th of November, 1889:—

"*Resolved*, That there be established the number of six scholarships for garden pupils of the Missouri Botanical Garden, to be available on and after April 1, 1890, such scholarships to be awarded by the Director of the Garden on the results of competitive examination, except as hereinafter provided, to young men between the ages of 14 and 20 years, of good character and possessing at least a good elementary English education; each scholarship to grant such privileges and be subject to such conditions as are provided below or may subsequently be provided by the Trustees of the Garden.

"Until otherwise ordered, two such scholarships shall be reserved for candidates to be named by the State Horticultural Society of Missouri, and the Florists' Club of St. Louis, respectively; provided, that such candidates shall be given scholarships only after passing satisfactory preliminary examinations, and shall be subject after appointment to all tests and regulations prescribed for other candidates and pupils, and that if the names of such candidates are not presented by the societies designated, within sixty days after such action is requested by the Director, the vacancies may be filled by him on competitive examination, as in other cases.

" Each scholarship so conferred, may be held by the original recipient for a period not exceeding six years, subject to the following conditions:—

" Each garden pupil shall be required to lead a strictly upright life, and shall be courteous and willing in the performance of all duties prescribed for him. He shall devote his entire time and energy to the labor and studies prescribed for him, except that from time to time he may be granted leave of absence to visit his home or for other good reason, at the discretion of the Director, provided that the aggregate of such absences in any calendar year shall not exceed thirty days. He shall also show such ability in his work and studies as to satisfy the Director that it is advantageous for the scholarship to be held by him; and from time to time he may be subject to both theoretical and practical examinations, or may be given special tasks calculated to test his knowledge or resources. Failure to meet the requirements in any one of these respects, making due allowance for extenuating circumstances, shall for-

feit all claim on any scholarship, which may then be awarded to another person in the prescribed manner.

"Garden pupils, appointed as above indicated, shall be regarded as apprentices in the Botanical Garden, and as such shall be required to work in it under the direction of the Head Gardener, performing the duties of garden hands. They shall be successively advanced from simpler to more responsible tasks; and, in such order as may seem best, shall be transferred from one department of the Garden to another, until they shall have become thoroughly familiar with the work of all.

"To the end that garden pupils shall be repaid for their services to the Garden, and that the absence of pecuniary means need not deter any young man from obtaining such training as is contemplated, each regularly appointed garden pupil holding a scholarship shall be entitled to the following wages, payable in equal installments at the end of each fortnight; For the first year, $200.00; for the second year, $250.00; and for each year after the second, $300.00; together with plain but comfortable lodgings convenient to the Garden.

"In order that they may have opportunity to become instructed in the theoretical part of their profession, and in subjects connected therewith, such pupils shall not be required to do manual work in the Garden for more than five hours per day after the first year, devoting the remainder of their time to the study of horticulture, forestry, botany, and entomology, under the direction of the Director of the Garden; and they shall for this purpose be granted free tuition in the School of Botany of Washington University. They shall also receive practical instruction in surveying and book-keeping, so far as a knowledge of these subjects is held to be necessary for a practical gardener charged with the management of an estate of moderate proportions.

"At the expiration of six years, the holder of a scholarship, who is recommended as practically proficient, shall be entitled to examination by the Garden Committee, in the subjects prescribed for study, and on passing such examination to the satisfaction of the Committee and Director, he shall receive a certificate of proficiency in the theory and practice of gardening, signed by the Chairman of the Garden Committee and the Director of the Garden. In exceptional cases, candidates may be admitted to examination at the end of the fifth year, when this shall be deemed advisable by the Garden Committee, and on passing such examination satisfactorily, shall be entitled to a statement to that effect from the Director, and to the regular certificate on the subsequent completion of a year's work to the satisfaction of their employers."

All applicants for scholarships, whether named by the societies indicated above or not, will be examined in the following subjects, so far as they are taught in the upper classes of grammar schools: English grammar, reading, writing, and spelling, arithmetic, and geography. If the number of candidates for scholarships exceeds the number of scholarships to be awarded at any time, all candidates except those named by the societies indicated, will be required to pass a

further competitive examination, which will cover history of the United States, English literature, algebra, German, the elements of botany, zoology, and physiology, and such other subjects as may from time to time be prescribed. It is not intended to make the passing of examinations in these last named branches a requirement for the award of scholarships, but merely in this way to obtain a means of selecting the most deserving and able candidates when it is necessary to reject some. Hence, the Director will always use his discretion as to the importance to be attached to greater or less proficiency in any of the subjects covered by competitive examinations, as well as to the other qualifications of candidates admitted to such examinations.

Under the above provisions, the following announcement is made: —

Two scholarships will be awarded by the Director of the Garden, prior to the first of April next. In case both are not then awarded, the remainder will not be awarded until the corresponding period of the following year, and vacancies which may subsequently arise will be filled annually, after published announcement.

Applications for scholarships, to receive consideration, must be in the hands of the Director not later than the first day of March. The preliminary examination for all candidates will be held on Tuesday, March 3d, at the Shaw School of Botany, 1724 Washington avenue, St. Louis, between 10 a. m. and 5 p. m. If the number of applicants exceeds two, competitive examinations, based on the subjects indicated above, will be held at the same place on Friday and Saturday, March 6th and 7th.

Candidates who live at places remote from St. Louis, and who wish to be spared the expense of coming to the city for examination, may send with their application the name and address of the principal of the nearest high school or of some approved private school, in case he is willing to take charge of such examination for them; but all applications of this character must be in the hands of the Director not later than the middle of February. If the examiner is approved, papers will be sent to him before the date set for the examination, and on the payment of a fee of $2.00 to him, the candidate may write on them in his presence. If competitive examinations are also required, the same examiner will receive the papers for them in time to submit them to the candidate on the date set for similar examinations in St. Louis, on receipt of an additional fee of $3.00 as a partial payment for his time in conducting the examination. The papers written on such examinations will be forwarded by the examiner to the Director, who will read them in connection with those written in St. Louis, before making any awards.

Successful candidates will be started in their duties as garden pupils on Tuesday, March 31st, at the Botanical Garden. They will be lodged in comfortable rooms in a spacious dwelling adjoining the Garden, under the charge of the Head Gardener or some other competent person. It is not the intention of the Trustees to furnish table board, but good board can be obtained in the lodging house or elsewhere at the usual cost. The lodging house includes a reading-room supplied with the

more valuable horticultural and agricultural papers, and also with a small but standard collection of books on the same subjects, which the pupils have free use of. So far as possible, the surroundings of pupils are made homelike, and without assuming any responsibility for their behaviour, an effort is made to subject them to influences calculated to insure for them gentlemanly manners and habits of industry and investigation.

During the first year of their scholarship, garden pupils will work at the practical duties of the Garden nine or ten hours daily, according to the season, the same as regular employees of the Garden, and will also be expected to read the notes and articles referring to the subject of their work in one or more good journals.

In the second year, in addition to five hours' daily work of the same sort, they will be given instruction and will be required to do thorough reading in vegetable gardening, flower gardening, small-fruit culture, and orchard culture, besides keeping the run of the current papers.

In the third year, in addition to five hours of daily labor, they will be instructed and given reading in forestry, elementary botany, landscape gardening, and the rudiments of surveying and draining, and will be required to take charge of clipping or indexing some department of the current gardening papers for the benefit of all.

In the fourth year, besides the customary work, they will study the botany of weeds, garden vegetables, and fruits, in addition to assisting in the necessary indexing or clipping of papers, etc., and will be taught simple book-keeping, and the legal forms for leases, deeds, etc.

The course for the fifth year, in addition to the customary work, will include the study of vegetable physiology, economic entomology, and fungi, especially those which cause diseases of cultivated plants; and each pupil will be expected to keep a simple set of accounts pertaining to some department of the Garden.

In the sixth year, in addition to the manual work, pupils will study the botany of garden and green-house plants, of ferns, and of trees in their winter condition, besides the theoretical part of special gardening, connected with some branch of the work that they are charged with in the Garden.

From time to time, changes in this course will be made, as they shall appear to be desirable, and the effort will be made to give the best theoretical instruction possible in the various subjects prescribed; but it is not intended to make botanists or other scientific specialists of garden pupils, but, on the contrary, practical gardeners.

Applications for scholarships, and any inquiries regarding them, are to be addressed as below, on or before the dates mentioned above. If requested, blanks will be mailed to persons who contemplate making application.

WILLIAM TRELEASE,
Director of the Missouri Botanical Garden,
St. Louis, Mo.

The training of the majority of applicants for information concerning the scholarships is very defective, many of them evidently having enjoyed few educational opportunities, and wishing scholarships for the manual training they offer, or regarding them merely as opportunities for employment. But the young men who have received scholarships appear to be accomplishing all that could reasonably be expected from the work of the first year. To provide accommodations for them, the building situated opposite the north gate of Tower Grove Park, and formerly known as the Casino, has been renovated and provided with city water, and plainly but neatly and comfortably furnished as a lodge. At present it is under the care of one of the Garden Assistants.

Early in April, Mr. J. C. Duffey, of the Experiment Station of South Dakota, was appointed Assistant in Horticulture, and has performed much useful work in bringing the younger and more manageable of the neglected fruit trees of the Garden into proper shape, and in experimenting with and practically applying insecticides and fungicides, and otherwise dealing with orchard and garden pests. As illustrating the difference between care and neglect in orchard and vineyard work, three photographs are here reproduced; two of them showing an apple tree as Mr. Duffey found it and after it had been pruned, and the other representing a few average clusters of bagged and unbagged Delaware grapes as they appeared at the season for gathering the fruit. It may be added that not a single unbagged cluster of any but the most worthless varieties of grapes reached maturity in better condition than the unbagged Delawares shown, owing to the attacks of fungi, insects, and birds, chiefly the last two. Mr. Duffey has also made some interesting observations on the habits and life-history of two beneficial insects, which he has recently published in the Transactions of the Academy of Science. During the winter, he has been granted leave of absence

A NEGLECTED APPLE TREE.

for the purpose of working on economic entomology in Eastern colleges.

The function of all educational institutions is to afford to their students the best practicable facilities for becoming well educated. Occasionally the older institutions provide traveling scholarships for the purpose of giving their most promising students opportunities for work which cannot be performed at home. I am convinced that the Garden can greatly extend its usefulness, and at the same time receive a direct return in material collected, by occasionally rendering it possible for its employees, or special students, to travel for purposes of study. As a first step in this direction, Mr. A. S. Hitchcock, one of my botanical assistants, has been granted leave of absence for the winter, to form one of a party organized by Professor Rothrock, of the University of Pennsylvania, for a collecting cruise in the West Indies. Some valuable material and interesting scientific observations may be expected to result from Mr. Hitchcock's journey, as well as much merited benefit to himself.

Although busily occupied by the necessary routine work of the library and herbarium, Mr. Hitchcock has found time during the year to complete a local Flora of a part of Iowa in which he formerly lived, and has recently published it in the Transactions of the Academy of Science. The only other botanical work of any size which has been completed at the Garden during the past year, is a monograph of North American species of Epilobium, on which I have been engaged for several years, and which will be published in the Garden volume containing this report.

THE SCHOOL OF BOTANY.

The recent publication* of a report on the work of the School of Botany during the first five years of its existence, renders it unnecessary for me to make more than a brief statement at this time. At the beginning of the present

* Garden volume for 1890, p. 84.

collegiate year, Mr. H. J. Webber, of the University of Nebraska, was secured as assistant, and during the autumn has given laboratory instruction in cryptogamic botany to an undergraduate class in the University, and in histological methods to a small special class, besides taking the principal charge of a special class studying the trees and greenhouse plants cultivated in the Garden and Park. The remainder of his time has been devoted to the necessary routine work of the school, including the preparation of specimens for a course of lectures which I am giving to the junior class in the University, and to special work in comparative histology which he is carrying on as a candidate for the Doctor's degree in the University.

The following announcement concerning the School of Botany is taken from the forthcoming Catalogue of Washington University: —

HENRY SHAW SCHOOL OF BOTANY.

ESTABLISHED JUNE 8, 1885.

Advisory Committee: — The Chancellor of the University, *ex officio;* John H. Lightner; Wm. G. Farlow, M. D.; Geo. J. Engelmann, M. D.

Instructors: — William Trelease, Engelmann Professor of Botany and Director of the Missouri Botanical Garden; H. J. Webber, General Assistant; Ellen C. Clark, Assistant at the Mary Institute.

GENERAL INFORMATION.

In June, 1885, Mr. Henry Shaw, of St. Louis, authorized the Chancellor of the University to place before the Board of Directors a plan of action for the establishment of a School of Botany, as follows: —

That he proposed with the concurrence of the Directors, to endow a SCHOOL OF BOTANY as a department of Washington University, by donation of improved real estate, yielding over $5,000 revenue, and to place it in such relation with the largely endowed Missouri Botanical Garden and Arboretum, as would practically secure their best uses, for scientific study and investigation, to the professor and students of the said School of Botany, in all time to come.

At the meeting of the Board of Directors held June 8, 1885, the following resolutions were, therefore, offered, in grateful acceptance of Mr. Shaw's proposal: —

"1. That a School of Botany be established as a special department of Washington University, to be known as the Henry Shaw School of Botany.

"2. That a professorship of botany be therein established, to be known as the Engelmann Professorship.

"3. That Professor Wm. Trelease, of the University of Wisconsin, be invited to fill the same; his duties to begin at the commencement of the next academic year, September 17.

"4. That said School of Botany be placed under the special care and direction of an Advisory Committee, to consist of five members, of whom two shall be members of this Board, and two shall be selected outside of the Board, — the Chancellor of the University being a member *ex officio*."

This report was accepted and the resolutions unanimously adopted. The record of such action was then submitted to Mr. Shaw and approved by him.

The laboratory of the School of Botany is temporarily located at 1724 Washington avenue, and a good working library, containing the usual laboratory manuals and periodicals, with memoirs on subjects likely to be studied, is kept in the laboratory for reference. This is being constantly added to, and will be made as complete as possible in any department of botany in which advanced students present themselves. The herbarium of the school will include as complete a collection as can be made of the wild plants of the region about St. Louis. Full sets of duplicate specimens are supplied for the use of students of particular groups of plants. Advanced students will also have the privilege of consulting, under certain restrictions, the excellent herbarium and library of the Botanical Garden, including the Engelmann herbarium and library, as well as several sets of *Fungi exsiccati* and the private cryptogamic herbarium and library of the professor.

Material for laboratory use, and for the illustration of lectures, is furnished in abundance by the Garden, which, with its greenhouses and arboretum, is open to students of the School of Botany for all necessary purposes of study. In case duplicate herbarium specimens which have been studied, are desired by members of the class, they may be retained if application is made at the beginning of the course, and are charged for at cost. Where alcohol and other expensive substances are used in quantity, a special charge for material used will be made at the end of the course.

The instrumental equipment of the laboratory includes one microscope by Zeiss, with a working series of objectives from A. A. to 1-18 inch homogeneous immersion, and accessories for spectroscopic studies and work with polarized light; ten microscopes by Leitz, with the objectives needed for the best botanical work (including five oil immersion 1-12 in. lenses, one 1-16 in. oil immersion, and one 1-20 in. oil immersion), polariscope, camera lucidas of several patterns, etc.; seventeen dissecting microscopes, mostly by Bausch and Lomb; and a number of simple tripods; sledge and rocking microtomes; a full set of bacteriological appliances; together with instruments, pipettes, reagents, and other necessaries. Microscopes, dissecting needles, and glassware, are furnished by the laboratory, members of the class being held responsible for breakage or other injury. Razors or other instruments for sectioning are not supplied by the laboratory for ordinary work.

The working year of the School of Botany is divided into three terms;

the first beginning with the College year and ending at the Christmas holidays; the second beginning immediately after New Year's and ending the last of March; and the third beginning about the first of April, and continuing until the Saturday before commencement. Classes for the study of particular groups of plants, and special work for advanced students, are planned as the demand for them appears. Whenever it is practicable, a class for day or night work, in any branch that can be taught with profit, will be formed on the application of six persons. The elementary classes are so conducted as to require no previous knowledge of botany; but admission to advanced classes depends upon a sufficient familiarity with the subjects to render the work profitable. Persons desirous of entering any class should present themselves promptly at the opening of the course. Correspondence is invited from those wishing special instruction.

Correspondence should be addressed to

WILLIAM TRELEASE,
Shaw School of Botany,
ST. LOUIS, MO.

. . . . .

In closing this report, I wish to express my grateful appreciation of the courtesy and cordiality with which I have been supported by the Board in every effort made in the interest of the Garden; and my thanks for many valuable suggestions and much kindly assistance given by the Garden Committee of the Board, and for the efficient and earnest work performed by my assistants and the gardeners of the institution.

Very respectfully,
WILLIAM TRELEASE,
Director.

ST. LOUIS, MO., Jan. 14, 1891.

A WELL PRUNED APPLE TREE.

ANNIVERSARY PUBLICATIONS.

PROCEEDINGS AT THE FIRST ANNUAL BANQUET TO GARDENERS, FLORISTS, AND NURSERYMEN.

GIVEN AT THE MERCANTILE CLUB, DECEMBER 13TH, 1890.

Under the provisions of the twenty-fourth paragraph of the fourth clause of Henry Shaw's Will, the Board of Trustees instructed the Director of the Garden to issue invitations for the first annual banquet to the gardeners of the institution, and invited florists, nurserymen, and market gardeners of St. Louis and vicinity. On the evening of the 13th of October, some sixty gentlemen assembled at the Mercantile Club. The gathering included representatives of the various horticultural interests in St. Louis; officers of the Missouri State Horticultural Society, and other prominent horticultural workers of the state; and the Presidents of the State Horticultural Societies of Illinois and Wisconsin. The Botanical Garden was represented by several members of the Board of Trustees, the Director of the Garden and his assistants, and the Head Gardener and his assistant. Among the guests present were the following:—

J. C. EVANS,
President, Missouri Horticultural Society.

J. M. SMITH,
President, Wisconsin Horticultural Society.

E. A. RIEHL,
President, Illinois Horticultural Society.

L. A. GOODMAN,
Secretary, Missouri Horticultural Society.

J. M. JORDAN,
Ex-President, Society of American Florists.

LEVI CHUBBUCK,
Secretary, Missouri Board of Agriculture.

PROF. J. W. CLARK,
Entomologist of the Missouri Experiment Station.

S. KEHRMAN, JR.,
Secretary, St. Louis Florists' Club.

N. F. Murray,
Vice-President, Missouri Horticultural Society.
E. G. Eggeling,
Superintendent of Parks, St. Louis.
L. Hunt,
Superintendent, Lafayette Park.
Hon. Isidor Bush.
Prof. M. G. Kern.
Alfred Plant.
A. Nelson.
J. W. North.
John Young.
Wm. Herne.
Chas. Connon.
Carew Sanders.
Chas. Patterson.
L. Armstrong.
Wm. Ellison.
Wm. Cook.
D. I. Bushnell.
C. Young.
J. M. Hudson.
Carew E. Sanders.
Eugene Wurst.
Fred. C. Weber.
Wm. Schray.
A. Waldbart.
C. W. Murtfeldt
J. Koenig.
H. Hegel.
A. Berdan.
Chas. Beyer.
H. Rieman.
Wm. Pape.
E. Schaper.
Jacob Stocke.
Geo. Ams.
F. Epstein.
J. Epstein.
A. Nieman,
and representatives of the Press.

The Board of Trustees was represented by

George S. Drake.
David F. Kaime.
Charles F. Miller.
Francis E. Nipher, and
A. D. Cunningham, Secretary of the Board.

The Botanical Garden was represented by

William Trelease,
Director of the Garden.
A. S. Hitchcock,
Assistant in Botany.
J. C. Duffey,
Assistant in Horticulture.
H. J. Webber,
Assistant at the School of Botany.
James Gurney,
Head Gardener.
J. W. Dunford,
Assistant Gardener.

At the close of the dinner, the Director of the Garden, who presided, said: —

Gentlemen: By the will of the late Henry Shaw, — the Founder of the Missouri Botanical Garden and the Shaw School of Botany, and the donor to this city of Tower Grove Park, — the Director of the Garden is required to

preside at an "annual banquet to the gardeners of the institution, and invited florists, nurserymen, and market gardeners of St. Louis and vicinity." It is my pleasant duty this evening to welcome you, on behalf of the Trustees of the Garden, to the first dinner given under this provision of Mr. Shaw's will; the first of a long series of what I hope may prove occasions of interest and profit, recurring each year with the ripening of the choicest fruits of our land.

Doubtless with the flight of years, these occasions will grow in importance and in value to all who may be connected in any way with them. But to whatever importance they may attain, none can equal in interest the present, which you have honored with your presence, for it inaugurates this feature of the Garden. It is fitting, therefore, that some mention should be made this evening of the reason for this particular institution.

To understand this fully, requires a knowledge of the man who has established it. A business man of unusual industry and application, Henry Shaw early reached the point where he felt that he possessed enough of this world's goods to supply the needs and carry out the highest ambitions of a man of his simple tastes and benevolent mind; and at the age of forty years he retired from active business and devoted the remainder of an unusually long and active life to the development of what we trust may come to be a most useful and beneficent charity. A lover of plants in and for themselves, Mr. Shaw was no less mindful of their utility in the economy of the human race, and of their exemplification of that Divine wisdom which he loved to contemplate and which finds recognition in the language of his will and in the inscriptions graven in the stone of which some of the Garden structures are built.

> "It was his faith — perhaps is mine —
> That life in all its forms is one,
> And that its secret conduits run
> Unseen, but in unbroken line,
> From the great fountain-head divine,
> Through man and beast, through grain and grass."

Beginning as the private grounds of a country gentleman some forty years ago, the Garden was soon enlarged to its present size. A most interesting account of what was then doing is to be found in the leading horticultural journal of that time, — *Hovey's Magazine of Horticulture*, — for September, 1859. But a greater enlargement came at this time in its scope; for with the extension of the grounds came the erection of a museum and library building, and its partial equipment under the stimulus and advice of the then Director of the famous Kew Gardens, — Sir William Hooker, — and of Mr. Shaw's friend and our fellow townsman, the late Dr. George Engelmann.

Inspired by the Chatsworth garden, — the residence of generations of cultured English gentlemen, — the Missouri garden took in this enlargement a step far in advance of its prototype, adopting as its new model the public garden at Kew, which from the residence and pleasure grounds of royalty had become, largely under the wise guidance of the man then at its head, the leading institution for scientific botany in the world. The history of its establishment, so far as the motives therefor are now obtainable, and the instructions in the will which places it on a permanent basis, show that Mr. Shaw hoped for a somewhat similar career of usefulness for the Garden founded by him. His plans, which occupied his mind during half a life-time after the outline was adopted, are left to us in a will which impresses all who have read it as a marvel of far-sightedness and wisdom, not the least evidence of which is his forbearance in defining minutiæ, leaving details, as he expresses it, "to those who may have to administer the establishment, and to shape the particular course of things to the condition of the times."

Among these plans, a prominent place was given to horticulture, in the broadest sense of the word, — the art of growing plants, and the sciences on which the successful practice of this art must rest. A personal acquaintance with Mr. Shaw during the last five years of his life, and a

careful perusal of his will, have convinced me that the Garden was intended to cover in its aims this broad field. To do this wisely, requires a more than superficial familiarity with the scope of the subject and with all that is doing in this country and elsewhere to elevate the art above the drudgery to which it is sometimes reduced. That the horticulture of this country may profit by whatever the Garden may find it practicable to do in this direction, and that the Garden may profit in laying and developing its plans by the ripest wisdom and the fullest experience of America's ablest horticulturists, will, I hope, result directly or indirectly from this institution which we inaugurate to-night. That associations favoring this mutual helpfulness might result from it, was, I do not doubt, the wish and object of the Founder of the Garden in providing for these annual gatherings.

In carrying out the ideas thus briefly outlined, the Garden must properly study how to avoid useless waste of material and energy, — how best to apply its resources that the greatest possible good may result. If I do not mistake the nature of the work before us, it should begin at home, and should first concern itself with problems of direct interest to the horticulturists of the unusually fertile though as yet but imperfectly developed region in which we are situated. It is our privilege to have with us this evening a gentleman who has for many years been connected with horticultural work in Missouri, and whose opportunities for studying its needs and for observing all that is doing for its improvement have been exceptional. We wish to profit by his knowledge, and it gives me much pleasure to introduce to you Mr. L. A. Goodman, the Secretary of the State Horticultural Society of Missouri, who has kindly agreed to speak on the horticultural needs of Missouri.

MR. GOODMAN.

Mr. Chairman and Gentlemen: The needs of Missouri in a horticultural line, I am sure, are so many and so various that I could hardly be given time to pass them over in detail, if indeed I can mention them in the few minutes allotted me. Missouri's fields are so broad, so fertile, the possibilities of Missouri are so extensive, that we have hardly begun to appreciate what we are able to do. In fact, asking what she needs seems like a question asked of a man who returned from a year's trip in Europe, where he had visited all the renowned cities of the old world. A gentleman sat down beside him and asked him to tell him all he had seen!

We believe in Missouri that we have one of the grandest states in the Union for horticulture. All along the Missouri river, from its mouth to where it enters the State in the northwest corner, we have a wonderful field for the development of the fruit interests especially. We have a magnificent apple orchard scattered along the Missouri river, and this is only a portion of what the state can do in the apple line. Only of late years have we found that in the southern part of Missouri, on the red lands of the Ozark range, are wonderful opportunities for fruit culture also. I may prophesy just a little and say that within the next ten or fifteen years we will see the peach belt of the United States along the southern slope of the Ozarks, and I believe I speak the truth.

The needs of Missouri in this matter can only be measured by the possibilities of the state. We have hardly reached a one-hundredth part of the development in this state which we can accomplish. There are hundreds of thousands of acres of land all over our State which ought to be and which will be in fruit. Speaking of the development of horticulture, I do not mean only in the fruit line,

but I mean in the broadest sense of the term, as it has been spoken of here this evening; not only fruits, but gardens, flowers, our parks, our cemeteries, our yards, our roadside planting and landscape gardening, — all these are interesting our florists, our seedmen and our gardeners; they all belong to this great realm of horticulture; and when you come to ask me the needs of Missouri in these respects, I must say that I can scarcely tell you what Missouri needs. We need good orchards first, and the knowledge required to grow those orchards. We need good gardens and development in the home adornment. We need development in the planting of the roadsides and in the flower beds of our yards, and also in landscape gardening. A noted landscape gardener came to Kansas City not many years ago, and I took him out to the south side of the city, and there, upon the hills as they were rolling out in beautiful lines south of the city, he said, "What a beautiful place to make a park! What a beautiful place for a residence portion!" And then he showed on the top of the hill, how a road ought to run, — just around the edge of it; not straight streets cut across the others at right angles, but with this main road winding around the hill. And I wished then that such a thing could happen. That is one of the needs. I would that we might see such a development in our landscape gardening, in laying out our grounds and in laying out the plans for the opening up of new lands adjoining our cities.

We need more knowledge in all this work. The knowledge that we have in the growth of horticulture is so limited. We hardly think that a tree can feel, that a tree can be injured, that a tree can weep; and sometimes, as I pass through an orchard, or as I pass through a yard, and see some trees broken, twisted, pruned wrongly, — why, it seems when I see a man doing that work, as if he was cutting my hand instead of the tree; it hurts me all over. Trees do feel; trees do weep — trees do ask for things to eat, for something to drink; and when we come to realize some of those things, we will better know what to do for them.

We need more knowledge in this respect, and I am glad that our scientists are taking this matter up, I am glad that our schools are taking this matter up, and we can get this knowledge from them. But we cannot do it all; as the Chairman has stated, the study part of the work has to come in a certain degree separate from the labor part, and so, as we try to do the labor part, we want our scientists in these schools and colleges to do the studying part, so that we may better know what to do to have successful orchards and gardens.

We want to be more business-like in our methods. We need to be more business-like in our development of the fruit interest and in the development of all parts of this horticultural work. We want to do more as the merchant does, as the lawyer does, as the mechanic does;— when we find a certain thing to be done, to go at it systematically, and judiciously, and earnestly, and make a success of that part of the work. We want, when we plant an orchard, to plant enough so that dealers will come and buy the fruit; we want to grow our fruits in lots of ten thousand bushels, twenty thousand bushels, and then, when we have a harvest to sell of ten or twenty or thirty thousand bushels of apples, it will be very easy to sell them. I have in my mind now a man in the western part of the state who sold an orchard for thirty thousand dollars. It is when men can come into these districts and get large quantities, that it is for our advantage, and so we want to be more systematic and more energetic, judicious and far-reaching in what we plan and plant.

While we need so many things, I hardly know how to state them. We want to know how to feed our plants. I wonder if we ever will; I wonder if you can ever tell us how to feed our trees (addressing the Chairman) so that they will produce a certain quality of fruit, a certain color of fruit. I wonder if feeding our trees has any thing to do with our success. I wonder if we can feed our trees as we feed our hogs and cattle, knowing that so much food will

produce so much flesh; I wonder if a time will ever come when we can feed our vegetables so that they will be coarse and watery or fine and firm in quality. We ought to have this knowledge; why can we not, Mr. Chairman, know more how to feed our fruit trees? we need to. Will our schools and experiment stations solve this question for us? We ought to know how to breed our fruits, our flowers, our plants; we ought to know what sort of apples to cross to get a certain quality of fruit; we ought to know what sort of pears to breed from to get a good winter pear, or one of the size of Duchess and quality of Seckel; we ought to know how to breed our fruits so as to produce the best results, or any desired results we are seeking, and we want you scientists to tell us how to do these things.

We also want new people to come in all over the state and share in the opportunities in this work that are offered throughout the state of Missouri. I tell you, there are opportunities offered for new men, new workers, all over our state, such opportunities too as are seldom offered to any people, and we want them to come in from all over the United States; we need the assistance of every one who is interested in horticulture; we need the assistance of every one who is interested in the growing of vegetables. Are you growing vegetables? Are you growing plants? Are you growing small fruits? Are you growing larger fruits? Are you a landscape gardener? Are you a florist? Are you a seedsman? If so, we want every one of you interested in this part of the work, viz., the development of our interests in this grand state of ours. The Missouri State Horticultural Society has been trying for the last eight or ten years to get as many of these interests as possible united. When we can accomplish this we will move forward in a body and not have only to present the needs of the Society, but we can then show the men who will fulfill these needs.

We need, lastly, love for this work. When a man becomes interested enough in horticultural pursuits so as to

become enthused with the pursuit, he never will let it go. There is something so fascinating about the growth of a fine orchard or a small-fruit plantation that you can scarcely find a man but who is enthusiastic over the matter. The horticulturists of Boston — and I suppose Brother Jordan can tell us something about his visits to their places — have a peculiar love for their work, which is evidenced by the magnificent results they attain. We ought to develop a love for this work also, because when we do develop such a love it gets hold of us so that we can never leave it alone. Above all, the cause of horticulture presents such a broad open field for the student in almost every branch of investigation, that there need be no hesitation of any young man fearing to enter because there is nothing to learn.

The Chairman: Mr. Goodman's statement of the needs of horticulture puts one forcibly in mind of the famous congressional prayer, —"More brains, Lord! more brains!" Some weeks since, the very practical Secretary of Agriculture, addressing a large audience of farmers in Ohio, said, "The future farmer will be more enlightened than we are to-day, in an even greater degree than we are more enlightened than those who preceded us because of the advantages we enjoy." No doubt he would have used very similar language had he been addressing a horticultural gathering, although in some respects horticulture is more advanced in this country than general agriculture. Close observers cannot fail to see that the general tendency of the times is to call for a constantly increasing intelligence on the part of those who are to succeed in any of the callings by which a useful and profitable living is to be made. It is true that innate genius may supply enough of this to lead in some cases to ample success; there will doubtless always be self-made men. But as time rolls on with its attendant increase in population, and competition becomes closer in all useful vocations, the vast majority of men must be brought up to the requisite level by suitable courses of in-

struction, made available and utilized during that early period in life when there is leisure for such schooling and when the mind is pliable and retentive. We cannot close our eyes to the indications even now before us that education is in nearly every calling a prerequisite to success, and that the man who is deprived of the opportunity to obtain it, either through his own willfulness or the deplorable force of circumstances, will in all likelihood soon find his permanent place in that large and steadily increasing class of our fellow-beings to whom life is but hopeless drudgery accompanied by privation and embittered by the thought that little more can be offered to their offspring.

As an educational institution, outside of pure botany, the Missouri Botanical Garden has yet to assume its place. But the wishes of its Founder in this respect are very explicit; and the Managing Board have already instituted a course of training for gardeners, from which much is hoped, although the number of young men to whom instruction can be given at any one time is very limited. This course has been in operation for about half-a-year. It is on trial, and we hope and expect to profit by whatever lessons are brought out by time, the real test of all things; but thus far I am pleased with the outcome. What it is proposed to do is, in brief, as follows: To take a limited number of boys or young men who have obtained a rudimentary knowledge of the English branches, and by offering them free lodgings, and wages sufficient to insure a bare subsistence during the time devoted to their studies, to practice them in all of the operations of the Garden, from the most menial up to the most responsible, at the same time seeing to it that they are given theoretical instruction in the direct line of their work and in such subjects as book-keeping, surveying, botany and entomology, and other studies that are considered necessary for a trained intelligent gardener,— such a one as either of us would wish his son to become if he were to be a gardener. This work has been started by the establishment of six scholarships, of which one is reserved for

the Horticultural Society of this state, and one for the Florists' Club of this city. Five of the six scholarships were awarded early last spring, and the young men who hold them have entered upon their work with an industry and intelligence, notwithstanding the rather discouraging nature of the course for the first year, which promise well for the future. They are lodged in a spacious dwelling adjoining the Garden, and have there, for their untrammeled use, a small but well-selected library, and a reading-room which contains most of the current horticultural papers published in the English language.

The success of such an effort as we are making in this direction, depends to no small degree on the class of young men who are attracted by it. It was to enlist the interest of the two societies that have been named, that scholarships were reserved for their nominees. The mutually helpful relations which we inaugurate this evening lead us to hope for your co-operation in what is intended to be a step forward in the elevation of gardening in the broadest sense of that word. One scholarship is vacant, no suitable applicant having appeared when the other awards were made. One has been vacated by a rather mature man, who has entered the employ of the Garden, having already had much of the theoretical work of the course in one of the Agricultural Colleges of the country, whose degree he holds. There will, therefore, be two vacancies to be filled on the first of April next, on the result of competitive examinations to be held a few weeks before that date. I mention this to-night, because I hope for your interest in calling the attention of suitable men of promise to them, so that the examinations on which awards are to be made shall be taken by young men capable of doing the best work that we can lead them in. As the years go by, I trust that I may be privileged to report the success of this step that we have taken, and to demonstrate it by introducing to such gatherings as this, graduates who may speak for themselves

and whose careers of usefulness may bear still more eloquent testimony.

The real usefulness of such a course as we propose to give, depends on the really useful character of the subjects taught. To decide what they should be, involves many considerations, and the question must be viewed from many sides. Vegetable gardening is by no means the least important branch of gardening, and it is a branch which Mr. Shaw expressly indicates as worthy of being taught in the Botanical Garden. We have with us this evening one who might speak to our profit and entertainment on any branch of horticulture, for he has long been identified with horticultural work of many kinds; but those who know him best reckon it not one of his smallest accomplishments that he has taken a piece of desert sand on the shore of one of the Great Lakes, and made it to blossom as the rose, — and more particularly to produce undreamed-of quantities of choice vegetables which find a remunerative market many hundreds of miles from the spot where they were grown, — even in our own city. It is my privilege, gentlemen, to introduce to you Hon. J. M. Smith, the President for many years of the Wisconsin Horticultural Society, whom, I am sure, you will agree with me, we shall be glad to listen to on the subject of the educational needs of a market gardener.

MR. SMITH.

Mr. Chairman and Gentlemen: The question your Chairman sent to me is — "What ought a market gardener to know?" If I should attempt to tell you all that a market gardener ought to know, I should occupy a great deal of time. I should probably have to learn, myself, many things that I do not know; and for fear that I might take more time than I ought to, or more than my share, I went to work and wrote out a few brief hints and will read

them, with your permission, thinking that possibly they may be of more service in that compact form than in any other that I could put them in. I will not occupy much time. I have only given a few brief hints, and will leave you to consider the subject, and whether they are worth your thought or not.

What ought a market gardener to know?

A number of years ago, a friend of mine purchased a farm. He was a gentleman of deservedly national reputation, and not entirely unknown among the savants and statesmen of Europe. Still, when he purchased the farm, he knew literally almost nothing about the cultivation of the soil, or of the general management of a farm. I had a number of friendly discussions with him at different times about the management and improvement of his new purchase, in one of which he made this remark: "I have been planting for some time on my farm, principally money, and have come to the conclusion that to be a good farmer, a man needs a better education, and a broader and more general one, than for any other business that I know any thing about." He was at the time a United States Senator. I replied to him, "Well, Senator, you have learned the first big lesson towards successful farming. Hundreds and thousands of so-called farmers pass their entire lives upon their farms, without learning the lesson that you have so quickly comprehended. I have great hopes that you will yet make a first-class farmer." The lesson taught by this grand and noble man upon this occasion, is fully as applicable to the market gardener, as to the general farmer. But you ask me what he should know? In the first place, he should know how to select a good location for his business. Many a man has been ruined by making a mistake here, that was fatal to any permanent success. If one has not a reliable home market, he should be very sure of good and reliable outside markets, with freight rates that will allow him to compete fully and fairly with all competitors. A second, and very important point, is the quality of the soil,

and its nearness to the market or depot, and the price at which fertilizers can be laid down in his intended garden; for he should also know that no soil is good enough to produce paying crops for any considerable length of time, without the application of plenty of fertilizers, and they must be obtained at reasonable rates. If he expects to raise very early vegetables, he should select, if possible, a light, sandy loam; as no heavy, stiff clay soil, however rich, can be made equal for earliness to a well enriched sandy loam. About the time that I commenced building up my present business, a bright, active young man commenced a market garden about one and a half miles farther from town than my own, but upon a heavy clay soil. We were competitors for a few years, and always good friends. He came to me one day and said that he was going out of market gardening. I asked him why, and he replied, "Your soil is from one to two weeks earlier than mine, in spite of all the efforts that I can make. This of itself gives you the advantage of nearly all the high prices for the first early crops. You can get to the market in half the time that I must take, and your earlier crops help you to control the outside market. The result is, that I can only have such customers as you cannot or do not care to supply."

It will be readily seen that the location and soil are of the utmost importance to any one who contemplates starting a market garden; as a few days difference in the time of putting things on the market, may make the difference between a nice profit and barely enough to pay the expense of growing, and sometimes not even that. But allowing that you have the right location, the best kind of soil, a short haul to market, with good roads, with plenty of good manure at your command at a living price, what then? One of the next things you should know, is when, where and how to purchase your seeds and plants. I am by no means sure that I am good authority upon this point, for I will confess frankly, that I get humbugged and deceived

more or less nearly every year, in my selection of seeds and plants. Of course I am anxious to grow the best of every thing in my line, and if there is something new and better than what I already have, I want it, and am willing to pay an extra price for it; but to pay an extra price for some so-called new variety of fruit or vegetable, and then to find it sometimes only an old variety, picked up and sold under a new name, and not equal to those I now have, is not conducive to any great peace of mind or body. Hence I will only say further on this point, that the greatest care should be taken to select good and reliable men to deal with, and then exercise the greatest care and good judgment in selecting your seeds and plants, or you will be sadly disappointed in the result of your year's labors. Then comes knowing how to plant, how to cultivate, how to sell, when, where and to whom, and at what prices. Some of the perishable crops, such as berries, lettuce, radishes, etc., must be sold at the time they are best fitted for the market, and must be so grown, and put upon the market in such a condition, as to be attractive and equal to the best, or loss instead of profit will be the almost inevitable result. The season of the year devoted to gathering and marketing perishable crops, is to the wide-awake and truly successful market gardener, one of ceaseless toil, almost day and night.

Please allow me to give you just a momentary glance at my own garden in this busiest season of the year. It contains 40 acres, and has three railroad depots and two steamboat docks within about one and one-half miles of its packing-house. The day laborers are supposed to put in ten hours per day, but to some others on and around the place, the time is quite differently arranged. The past season, one express train left for the north at 2 o'clock a. m., and some of our customers wished their berries and other things shipped on that train. In order to have them reach their destination in first-rate condition, they were left in our cooling house until one o'clock a. m., and then taken direct to the train,

as we know by past experience how expressmen handle fruit. Between 4 and 6 a. m. two other trains leave, between 10 and 12 (noon) two more, and from noon to 9 p. m. several more, several of which we must meet, besides the steamboats and the home trade to be looked after; while in the garden are from seventy-five to one hundred men, women, boys and girls to be looked after in their several departments, to prevent loss and waste. The weeds, as well as vegetables and berries, are growing rapidly, and the weeds must be destroyed at any cost. This condition begins with the strawberry season and lasts until the end of the currant season. Think you, it costs no care and thought to keep all these things moving along harmoniously and profitably? I have sometimes thought that if there was any place upon this earth where a lazy man was more useless than any other, it was in a market garden. As regards crops that are not so perishable, one needs to know the condition of the markets of the country; where there is a deficiency, if anywhere; and the rates of freight to such points; also the best business men in that line of produce at such places. It is also absolutely necessary that one should keep himself posted by reading papers, magazines and books that are devoted to the business in which he is engaged. No one can afford to ignore the recorded experience and best thoughts of our best men in the business, as given in such papers and books. Perhaps you are ready to ask, as I have often been asked, cannot a man become a good market gardener by simply reading and studying our best books and papers? On this subject, I have no hesitation in answering this question in the negative. As well might a man undertake to build a fine house by simply studying a book of designs. A man may be learned in all the lore of both ancient and modern gardening, and it will aid him much in his way toward success; but nothing will supply the place of every-day, level-headed common sense. He will still make many mistakes, but he must learn by his mistakes as well as by his successes. I have thus in a very

brief way indicated a few things that are imperatively necessary for a successful market gardener to know. Do you ask, What will be the result if we follow out the rules you have laid down for us? Well, you will not, even with all the advantages I have named, ever become a millionaire. They are never found among market gardeners. On the other hand, a good, level-headed, intelligent, industrious and persevering man will seldom fail to win at least a moderate fortune; and there are a good many of them in the country who are worth many tens of thousands each. As for myself, Jay Gould or Vanderbilt would no doubt call me very poor; still, wife and I do not feel so. It is nearly one-third of a century since we commenced our present business, though for several years in a very small way. The business has grown, and we have grown with it. We have passed through many changes, some very discouraging, some quite otherwise. We have given the best efforts we were capable of, to our work, and its results have been reasonably satisfactory. Our seven sons have been our best helpers and have all grown up with habits of industry, temperance and economy. Six of them are following the same business as ourselves, and are doing well, and the seventh is also a cultivator of the soil, and will, we trust, do well, as he is upright, honorable and intelligent. I do not know of any other business in which wife and I could have been happier, and perhaps in no other could we have been more useful in the community generally, than in that of market gardeners.

The Chairman: "I do hold it in the royal ordering of gardens," says Lord Bacon, "there ought to be gardens for all the months in the year, in which, severally, things of beauty may be then in season." Under a perpetually shining sun, and in a climate untouched by frost, such a garden would be the ideal surrounding for a rural home. The climate of our Mississippi Valley, while it is far from being the worst conceivable, does not permit us to realize

this ideal in the open air; but by the judicious employment of cold houses, and temperate houses, and tropical houses, — or stoves as our English friends would call them, — substantially all may be realized. There is a prevalent notion that the growth of flowers for the market is one thing, but that the maintenance of a conservatory for the adornment of a gentleman's home is entirely another matter, so far as the money question is concerned. It is hardly necessary for me to state my own views on this point, but I trust that I may be pardoned if I say in passing that I am far from being convinced that similar business supervision of expense and methods in the two cases would not produce very similar results in the end. We have with us this evening a gentleman who has for many years been associated with the floral business of this city, and who is perfectly competent to teil us what is necessary to insure practical success in the commercial growth of flowers. It is my privilege to introduce Mr. J. M. Jordan, Past-President of the Society of American Florists, who has kindly agreed to speak to us on "the commercial florist."

MR. JORDAN.

Mr. Chairman and Gentlemen: This is a task assigned to one who has had some little experience in the practical workings of commercial florists; but just how to present the question it is difficult for me to determine. The commercial florist's occupation is a very ancient one. We cannot tell exactly how long ago it was followed, because we read of the commercial florist in Grecian mythology. We have an account, as I believe, of the first florist that ever attempted to make a livelihood by selling flowers. There was a lady, supposed to be a beautiful Grecian artist in her way, Logena by name; and the legend runs on that this beautiful lady gathered wild flowers and wove them into garlands and sold them in the market, or, more particularly, in the Athenian places of sport and merriment.

When some competitor had won a prize, she would weave a garland and sell it to an admirer that he might crown the victor with a wreath of flowers.

That seems to be about the first account we have of selling flowers. We are left in ignorance of any thing before this time, but this serves to show that this profession of ours is one of very early date. Some go back and say that Adam was a market gardener, but I think that he rather ran a kind of combined zoological and horticultural garden than a market garden or a florist's business. At any rate we give to this young lady of the legend the credit of being the pioneer commercial florist of the world. And there are some little incidents of this legend very similar, indeed, to our every-day experience nowadays. It was only a short time after this lady started in the business of floriculture that a rival came along—a rival from a neighboring town or city of Byzante, now known as Constantinople: and this young man, like the young men of to-day, I presume, saw that there was money in this commercial florist's business and so he set up in the business himself, close alongside of this young lady. Very much as, to-day, when a commercial florist starts in business in a certain location, somebody comes along pretty soon and starts up next door, or across the way.

The disposition of the people at that time was very much the same as it is now, because there was friction very soon created between the two. Possibly they had not studied that higher law of business, that the more opposition or competition there is in a business the greater amount there will be of that business. Those who are better informed, I think, believe it is better to have a number engaged in the same profession, although we find that same friction to-day. Well, this young man that came along there and started up in the business rather displeased the young lady, and she, like most young ladies of the present day, had a lover, and he would come around at evenings, I suppose, after he had done his day's work, and finished the chores,

and would sit down and talk with her, and at last she says to him: "There is a bad fellow around here in the neighborhood and I wish you would scare him away." Well, he took it rather seriously, and meeting the young man as he came out of the cow pasture, or, perhaps coming up through the lane, one evening, he commenced to "make faces" at him and finally squared off at him and then sailed into him in the true ethical style as followed in Boston by John L. Sullivan, and he whaled the fellow all to pieces in a little while. The consequence was that the customers of this young man rather took it to heart and, as the legend says he was the man who fixed up the flowers for the poets and literary men of the day, they thought that they ought to do something to avenge his death. So they consulted with Apollo to know what to do about it. Now Apollo, as far as we can learn, was a pretty shrewd kind of an old fellow who didn't like to go to work and do any thing very atrocious to this young woman. He had some of the gallantry that people have nowadays and he studied it over and concocted the plan and said, "Now, I will turn this fellow who has lost his life in an honorable, industrious occupation, into a flower, and I will make this young lady use this very flower if she continues in the business." And so, from the blood that was spilled, there sprang up beautiful carnations or, perhaps, sunflowers or golden-rod; it does not say exactly what kind of a flower it was. But the young lady was compelled to use these very flowers in her work and to sell them to her customers, and at last she got to love them, — to really love the fellow himself through the flowers he manifested himself in.

Now there is a lesson right here in this story for the commercial florists. It teaches us to have regard for each other, to have something in common with each other. There is too much of that friction and jealousy. There is too much of that wanting to do every thing ourselves: wanting to do it independently of every body else, unlike any one else. My few years' experience has taught me that the

more we can get together with one idea, one pursuit, assisting one another, having a common feeling for our associates in business, the better it is for us. We cannot any one of us own all the flowers. We cannot market all the flowers. We cannot supply all the customers. We do not have the ability to do it; we have not the means nor the time to do it; and therefore it must be parceled out to a great number.

The florists' business of the country and, I might say, of the civilized world, has been given a great impetus of late years. There has been some little effort made lately to ascertain the rate of increase of the business from year to year, and I think that with the completion of the present census considerable light will be thrown upon this particular branch of trade. We know now that there are about twenty-five millions of superficial feet of glass used in these United States in, to a large extent, the commercial florists' business. It is a business which ranks second to none in this country in regard to enterprise, energy and push; and, like the market gardening business spoken of by my friend Mr. Smith, ours is a business which looks more particularly for a home market. It is a very perishable commodity indeed we handle. Although large quantities of flowers are shipped long distances, it is only with great care in selecting varieties and in handling them that this is done successfully. There are many things that we have yet to learn in regard to the successful carrying on of the commercial florists' business. It has been but within the last twenty-five or thirty years that it has taken what I may call a front rank in a horticultural sense: — since the war, in fact. And one thing which a great many of the commercial florists at the time deprecated, was men of wealth going into the business for the money that there was in it solely, — investing large amounts of capital, employing skilled labor, the best they could command, for the mere money there was in it. I can only say that a very large number of those men have not found it as prof-

itable as they expected they would. And that opens up another idea, which I am sure you will all bear me out in, and that is that very few commercial florists have ever succeeded in their profession who did not love the business, who did not love their plants and their flowers, who did not live with them and sleep with them. Unless a man love flowers he had better not undertake their cultivation. He must prize them not for their mere money value but for their beauty, their influence, their refinement and their refining tendencies.

And that opens up to us another subject: the good the commercial florists may derive from the bequest of our late friend Henry Shaw. I tell you, gentlemen, that that bequest, if properly handled, and I hope it will be and it has every appearance at present of being so handled,—will be worth millions to us, if indeed we can measure such a thing in dollars and cents. It has set an example to every man of means in this country, and shown him that there is a wide field for the development and increased usefulness of horticulture in its various branches and more particularly in floriculture. We are indebted, and ever will be indebted, to Henry Shaw and to the Trustees who will manage that estate for all time to come; and it is our duty, as it will be for our interest, to assist and encourage by every act in our power the work that has been so nobly begun.

I am glad to hear the report from Professor Trelease in regard to the working of the school he has established here, and I think we will reap much benefit from the results of that school. It will give us a class of young men, once they shall have begun to graduate from the school, who will be able to enter the practical part of the business, taking hold from the very start, and reasoning from cause to effect; who, when called upon to do a certain work, will have the knowledge to discern whether it is in accordance with what is known of the laws of botany or horticulture as a science; and through that means we hope to stand on a

higher plane, better educated men, engaging in the pursuit of the commercial florist.

The Chairman: "To collect every information respecting the culture and treatment of all plants and trees, as well culinary as ornamental" is officially stated to be the object of the famous Royal Horticultural Society of London. The object of any horticultural institution may well conform to this outline, so far as its ability and means permit. Collecting information, however, is much more than compiling; and the institution which shall attempt to come up to the standard set by the Royal Society, must soon assume the character of a scientific establishment if it rightly estimates the work that it has laid out for its performance. For many years the grounds at Rothamsted, England, have been celebrated because of the extensive experiments on the laws of growth of plants which have been carried out there under the direction of Gilbert and Lawes. In our own country, it is not many years since one or two experiment stations were started in a small way by private means or under the care of some educational institution. But thanks to the efforts of the friends of progressive agriculture, and under the leadership of a representative of our own state, the National Government now appropriates each year a fairly large sum for the use of each state in the prosecution of such work as properly falls under the denomination of experimental investigation. Horticulture, in one or another of its branches, is the subject of experiment at nearly all of these Stations. It comprises so much in chemistry and physics and meteorology, that it requires the best guidance possible in these directions. We have with us this evening one who is recognized over the entire country as eminently qualified to speak as a scientific man on at least two of these subjects. It is the more felicitous that he also represents the Board of Trustees of the Garden. I have the pleasure of introducing to you Professor F. E. Nipher, of Washington University, who will illustrate what is meant by "experimental work."

PROFESSOR NIPHER.

I feel some hesitation in talking about horticulture on such an occasion as this. It is true I am not wholly in the dark upon the subject: In common with all schoolboys in our region of the country, I profited by the conventional treatment of the subject which was much in vogue, learning something from observation and much more from experience. It is a matter of memory with me that the master did not always draw upon the neighboring apple orchard, but occasionally drew upon the treasures of the beech grove behind the school house. Later I remember of desperate contests with the army worm; of certain drastic applications of soft soap and water to the unresisting caterpillar; of many a still hunt for the unobtrusive but insinuating apple tree borer. With these experiences of a farmer's boy of twenty-five years ago, my horticultural training terminated.

It is, however, impossible for any intelligent person to fail to see how intimate is the relation between intelligent horticulture and certain branches of science. Not only have the results of investigations of botanists, entomologists and biologists enabled you to avoid mistakes by revealing the causes of failure, but the scientific method has become your property.

I remember that when I was a youth of ten years our village schoolmaster was considered a man of very singular habits, a most extraordinary man. He caught flies and beetles, butterflies and moths (or millers as we called them), he collected plants and weeds and he spent his noon hour in taking them apart. He made drawings of their internal arrangement and seemed much concerned to pry into matters which other persons in the community did not consider of pressing importance. He finally gave a lecture to the old folks on the "Equilibrium of Nature;" and I have seldom seen a botanist or a gardener, that I did

not think of what he said. He pictured the peaceful groves, orchards and fields of our neighborhood as a scene of deadly and unrelenting war. He showed that every worm, insect and bird was continually hunting its prey and was in turn being hunted by its enemies. It is this wholesale butchery which keeps insect pests at bay. Sometimes unusual drought or wet will give certain species an advantage. They become numerous, and then their enemies thrive and the balance is restored. And he predicted that the horticulturist and farmer would finally take an intelligent hand in this war: that they would encourage their insect friends in the slaughter of their insect enemies.

In a former, a pre-scientific time, if crops failed, or the plague came, the matter was intellectually disposed of by saying that the evil spirit did it or the angel of the Lord brought vengeance. Now we hunt for bacteria. This is the distinctive feature of science, to seek a rational explanation of things we do not understand.

It is a great step to replace the unreasoning fatalism of the pilgrim to the shrine of Mecca, by the staining solutions and the microscope of Koch. The same methods applied to the enemies of the horticulturist have produced like results. And they will produce yet greater results. The number of remedies in reach of the physician continually increases. Similarly, the means of warfare against your insect enemies must increase. The number of chemical compounds that may be produced from the known chemical elements is too vast for comprehension. The city of St. Louis does not contain houses enough to hold the books which would contain only the names of the substances which can be produced from the known elementary substances. If all the scientific men on the earth had begun to make and study these substances, with a view of finding out what use could be made of them, and had continued in ceaseless labor from the dawn of history until the present moment, their work would have just begun. They

would have made no appreciable impression on the stupendous task.

Some of these compounds are explosives. Some are medicines, which produce special effects on animals. Some are poisons. Some are fatal to insects and harmless to vertebrates. Here is a vast store-house, with material for unending progress. Some of this material, some of this labor, some of this progress, is for you. We are fortunate, that in our city has lived a man who has founded an institution broad enough for your highest and best needs.

I know that the strongest men of our time have turned their eyes in our direction. They predict that the institution which Mr. Shaw founded will do great things for science and for human welfare.

The Chairman: "A cottage and a slip of ground for a cabbage and a gooseberry bush," says Horace Walpole in his essay on modern taste in gardening, " were in all probability the earliest seats and gardens: a well and bucket succeeded to the Pison and Euphrates. As settlements increased, the orchard and the vineyard followed; and the earliest princes of tribes possessed just the necessaries of a modern farmer." To the landscape gardener is due much credit for the transformation of many a waste and many an unattractive piece of ground, into a miniature reproduction of that Eden from which our first ancestors are said to have been driven forth to eat their bread in the sweat of their brow, in an effort to compel unwilling Nature to yield them sustenance. To the unselfish work of the horticulturist and the landscape gardener, is directly attributable all that makes rural life attractive to any but the sportsman. We have with us this evening one who has devoted his life to this work of making homes and improving their surroundings, and who, in connection with one of the gentlemen who has already spoken, has done much to inculcate a love of the beautiful in nature in our children, by making

the surroundings of their schools the means of forming correct tastes at the period when the mind is most impressionable. I do not need to say that I refer to Professor M. G. Kern, who has kindly consented to respond to the sentiment "the landscape gardener," and whom I have much pleasure in introducing to you.

MR. KERN.

Mr. Chairman and Gentlemen: It gives me a great deal of pleasure to respond to the honorable mention of landscape gardening, a profession and an art to which I have devoted many of the most active years of my life. All of you gentlemen present here know how much Mr. Shaw has done for horticulture, but I would especially call your attention to his assistance and to his influence and to his noble offer to St. Louis of Tower Grove Park. He made that offer at a time when a certain popular indifference prevented the inauguration of such park improvements as a city of the size of St. Louis and of the importance of St. Louis demanded. At that time Mr. Shaw came forward with his most liberal offer of the site of Tower Grove Park. This very offer of his and his influence have paved the way to that system of public parks and prospective boulevards which we have at the present day. The sylvan beauties of Tower Grove Park, together with the attractions of the Garden, are truly a most noble object lesson for the generation in which Mr. Shaw lived, and a really blessed message to a coming century.

As for landscape gardening, I would wish to say that the art which has created all the ornamental grounds of modern times is commonly called landscape gardening. It is a compound of horticulture, of architecture, and of civil engineering. In consequence, we have a variety of landscape gardeners;— landscape architects, landscape engineers and landscape gardeners; — but no matter under what

division they are placed, no matter under what color their different little ships may sail, horticulture after all furnishes all the trim to the sail, furnishes all the material of decoration, besides the necessary knowledge and intelligence to use the material for decoration successfully. Horticulture as an agent or as a medium for the decoration of grounds, works in two ways, in two directions, which may be said to run parallel to each other up to a certain point. One direction I may call ornamental gardening at large. This branch of horticulture takes into consideration only the ground on which it operates. It builds the ground which it has to treat into beautiful lines. It creates beautiful flower combinations, beautiful shrubberies, and decorates it with all the materials of ornamentation. Landscape gardening, on the other hand, takes not only the ground, but the sky itself into consideration. It creates sky-lands. It sets up those beautiful combinations of trees which form a sylvan decoration of a certain stretch of ground. In this respect landscape gardening is entirely different from ornamental gardening. Ornamental gardening is part of landscape gardening, but it is not all of it.

This ornamental planting, as it may be called, is the branch of horticulture which is most to be recommended to the rural population, because rural districts will not and cannot indulge in the more expensive process of ornamental gardening. Flowers and all expensive ornamentation are, with a great many, out of the question. But every man who owns a home in the country can ornament his homestead with beautiful groves, with beautiful trees, with beautiful surroundings, at very little expense. And I see the greatest future for landscape gardening in the spread and advance of the knowledge of the most simple principles of the art, by which the sylvan features of every spot of ground which is inhabited by an American citizen can be improved and made beautiful. And let us look for one moment at the benefits, at the blessings and changes which our rural districts may experience by thus beautifying the

homes of the common people and, we may say, of every body who has room for a few trees. While the city will very easily take care of its own improvements, this art, this branch of horticulture, is to be introduced and developed amongst the masses of the people themselves. And it is with this object in view that I have worked for many years, and to accomplish which I have used every effort as far as was in my feeble power.

The Chairman: Many friends of horticulture from our own vicinity and from a distance have written kind and appreciative letters expressing regret at inability to meet with us this evening. Time permits me to present but a few of those which I have received.

FROM THE BISHOP OF MISSOURI.

WHITEHALL, ILL., October 2, 1890.

My Dear Prof. Trelease:

I have the invitation to the banquet to "Florists, Nurserymen and Gardeners," to be given on the 13th inst. I greatly regret that I must be in Toledo, Ohio, that day. I would much like to be present with you all at the banquet.

It is a well-earned joy that the workers among flowers and plants and trees can be enabled to sit down together for a few hours of most pleasant and social converse. The touch of kind-heartedness manifested in this direction of Mr. Shaw's bounty gratifies me exceedingly.

I wish I could be with you. Will you kindly say my regrets and my warmest wishes for a pleasant gathering to all there assembled.

Faithfully yours,

DANIEL S. TUTTLE.

FROM THE SECRETARY OF THE MASSACHUSETTS HORTICULTURAL SOCIETY.

HORTICULTURAL HALL, BOSTON, Oct. 2, 1890.

Dear Sir: Your kind invitation to the First Annual Banquet to Florists, Nurserymen and Gardeners, instituted by Henry Shaw, was duly received, and I return you hearty thanks therefor, not only on my own account, but in behalf of this society, for I presume that the invitation was sent to me not merely as an individual but as a representative of the society. I wish it were in my power to accept the invitation, for it would give me great pleasure to join with you in the institution of what I trust will be a long series of pleasant and profitable meetings, and in

honoring the memory of its founder; but it is impossible for me to attend, and I can only send my regrets.

I believe there has been no year since the foundation of the Massachusetts Horticultural Society in 1829, when either the society, or its committee of arrangements for the annual exhibition, with invited guests, has failed to sit down to a dinner together, and I can bear witness to the fact that these gatherings have had a most excellent effect in promoting a feeling of brotherhood and harmony among all who have participated in them, and I do not know that I can send you any better wish for the occasion to which you have so kindly invited me than that it may be the first of a long series which shall have as beneficial an effect as our own similar gatherings, and shall exert a wider influence for good.

Yours truly,

ROBERT MANNING.

FROM THE CHIEF OF THE FORESTRY DIVISION, UNITED STATES DEPARTMENT OF AGRICULTURE.

WASHINGTON, D. C., Oct. 4, 1890.

My Dear Sir—I regret that the disposition of my time for the present month is such as to prevent me from attending the pleasant meeting to which I have your kind invitation.

In my official position I have a special need and desire to cultivate the good-fellowship of just the men that are to be gathered at your banquet. It is through them that at least the extension of our forest areas can receive an impetus, and, as florists, nurserymen and gardeners are, like myself, engaged in studying the practical application of biological facts, I should have promised myself much profit from such an intercourse with them.

May this first of a series of banquets be so full of pleasure and profit to all present that it will justify their institution by the generous founder, and let me hope that one of its sequels will find me in position to take a seat at your table.

Very truly yours,

B. E. FERNOW.

FROM THE PRESIDENT OF THE SOCIETY OF AMERICAN FLORISTS.

BOSTON, October 1st, 1890.

Dear Sir — Your kind invitation to attend the banquet on October 13th duly received, and for which accept my sincere thanks. As I promised to act as one of the judges here at the Chrysanthemum show on the same date, and have one other engagement the same week, I will not be able to join you on that occasion. And I regret very much that there are not more public-spirited citizens like the late Mr. Henry Shaw, of your city, to remember the florists and gardeners in such a kindly manner.

I remain, yours truly,

M. H. NORTON.

FROM THE HORTICULTURAL EDITOR OF THE COUNTRY GENTLEMAN.

UNION SPRINGS, N. Y., Oct. 4, 1890.

Gentlemen: I gratefully acknowledge, and on behalf of the *Country Gentleman*, of Albany, N. Y., the receipt of your kind invitation to attend the Annual Banquet of Florists, Nurserymen and Gardeners, instituted through the noble munificence of Henry Shaw, and to be held on the 13th instant, at St. Louis, and I sincerely regret my inability to be present on the occasion, and to witness what he has thus accomplished for the benefit of his fellow-citizens, and for the whole country, so eminently worthy of their admiration.

Very respectfully,

J. J. THOMAS.

FROM THE BOTANIST OF THE BOARD OF AGRICULTURE OF PENNSYLVANIA.

GERMANTOWN, PA., Oct. 8, 1890.

My Dear Sir — I very much regret that it is not in my power to accept your kind invitation to be present at the Henry Shaw Banquet on the 13th inst.

I am the more sorry, as I have an earnest desire to see some of the good work of my many-year friend, knowing as I do the underlying motives that prompted much of his bequests. Other opportunities will, I trust, occur to me some time.

Very truly yours,

THOMAS MEEHAN.

FROM JUDGE SAMUEL MILLER.

BLUFTON, MO., Oct. 5, 1890.

Dear Sir — Your kind invitations to the Shaw Banquet both received; but when the first came I was too ill to answer, and now I regret to state that it is not likely that I can attend. My late sickness and age (79 yesterday), caution me to stay home. My presence may not be impossible, however. Let me tell you that I highly appreciate the honor, and it would no doubt be a great pleasure to me to meet so noble a crowd of congenial spirits.

If not with you in body I will be with you in spirit, and when it comes to the giving of toasts, mine will be given in writing if admitted in that way. When we have all crossed over the Dark River, may we meet the noble Henry Shaw on the bright plains o'er which the rivers of life flow; and where the noon-tide of glory reigns forever.

Yours fraternally,

SAMUEL MILLER.

The Chairman: It is a matter of pride with every Missourian that the official entomologist of this state was the first to work out the life history of the *Phylloxera*, that insect which has proved so troublesome to the French vineyards. With this came discoveries in regard to the habits of the insect, came the further discovery that the roots of our American vine are more resistant to its attacks than those of any European form of vine. Attending this came a very great demand for American vines as a means of saving the French vineyards. We are fortunate this evening in having with us a gentleman who has been very intimately connected with this work of renovating the French vineyards, the Honorable Isidor Bush, who has kindly consented to make a few remarks, and whom I have the honor to present to you.

MR. BUSH.

Mr. Chairman and my Friends: At this very late hour I will certainly beg you to excuse me if I do not speak upon a subject of the sort mentioned. You have had most practical and interesting discussions and papers on the subjects of market gardening, and of fruit culture, and, besides the practical, our dear friends, the florists, have led you into the realm of Grecian mythology and legend; and science has been ably, though in but few words, treated by our friend and scholar, Mr. Nipher; and so with landscape gardening. But one thing, in your modesty, Professor, and one which seems to me to be the one thing indispensable, was neglected; and it is certainly meet on this occasion, when we so enjoy the blessings showered upon us, to refer in memory of that great and good man, Henry Shaw, to the one thing which he most cherished, which was botany. The botanists seem to have been somewhat neglected. And so much so is this important thing neglected that, with all the science and learning displayed here, still I believe

that very few men, not excepting the gentlemen present, know who was the first botanist and what was his method of classification. Do you know that, Professor? Well, allow me to tell you that it was a man whom all the world knows and it is written in a book which the whole world knows. It is in the first chapter of the book of Moses called the Bible. And I will tell you how it reads and you can convince yourself, no matter in what translation, and you will see that on the third day the plants were created and that he classified them in only two kinds: plants bearing seed directly, each of its kind, — I know it better in Hebrew than in English, — and plants bearing fruit wherein the seed is contained, each of its kind; and that was the classification of over four thousand years ago by that old teacher, or law-giver as they called him, Moses. And every one who will look in the Bible will find expressly this classification. It is very simple. It may not be complete, but it is a botanical classification. I leave it to Professor Trelease at another opportunity to go over all the other greater and later botanists, to whom my friend the late Henry Shaw has even erected statues, — and to one a greater statue than marble or bronze, — the collected works of my deceased friend Engelmann. I thank you, my friends, and I hope you will not forget the botanist.

The Chairman: The lateness of the hour, gentlemen, and the fact that some of us have a long distance to go, renders it impossible for us to linger longer, though we might do so profitably, were this not the case. But one word, therefore, remains to be said, — a word of thanks for your presence this evening and for the interest you have shown and the good wishes that have been voiced for the future of what we who are called on to guide it trust may be made, as time goes on, a useful adjunct to progressive horticulture in all of its branches.

SCIENTIFIC PAPERS.

A REVISION OF THE AMERICAN SPECIES OF EPILOBIUM OCCURRING NORTH OF MEXICO.

BY WILLIAM TRELEASE.

In addition to species which have been singly described in various papers, and those treated in more restricted floras, the North American representatives of the genus *Epilobium* have been comparatively described by De Candolle,* Torrey and Gray,† and Haussknecht.‡ The first and last of these accounts include general monographs of the genus. The second, enriched by manuscript descriptions by Nuttall, has the same scope as the following revision, but of necessity refers to a smaller area of well-explored territory. The more notable works of more limited range which deal with North American representatives of the genus are Hooker's Flora Boreali-Americana (the first volume of which bears the date 1840, although the first part was issued in 1829 and the second and third parts before the end of 1832), and Brewer, Watson and Gray's Botany of California (the first volume of which was published in 1876). Both refer chiefly to west-coast species. In the former,¶ *Epilobium* is treated by Lehmann; in the latter,§ by Barbey, who subsequently published excellent illustrations of the species described there as new. ‖

The following pages contain the results of such study as

---

* Prodromus, iii. 1828, p. 40 *et seq.*
† Flora of North America, i. 1840, p. 486 *et seq.*
‡ Monographie der Gattung Epilobium, 1884, p. 237 *et seq.*
¶ 1832, p. 204 *et seq.* § 1876, p. 218 *et seq.*
‖ Epilobium genus a cl. Ch. Cuisin illustratum, 1885.

I have been able to give the genus during something over two years. The material employed has been chiefly that contained in the Gray herbarium of Harvard University, the herbaria of Columbia College, the United States Department of Agriculture, the Geological and Natural History Survey of Canada, and the Missouri Botanical Garden, and the excellent private collections of Mr. W. M. Canby and Mr. H. N. Patterson. My thanks are due the gentlemen owning or in charge of these collections, for their courtesy in allowing me to retain the material for the long time needed, and I am also indebted to numerous correspondents for the communication of smaller collections or single specimens.

In all of the local floras and the herbaria of the country, much confusion prevails as to the species of *Epilobium*. For this reason I have referred for synonyms to Watson's Bibliographical Index to North American Botany only in cases where little or no exception could be taken to it.

As a rule, fewer species are distinguished than can be recognized by one familiar with the rather slight specific differences that exist, and their relative importance in different groups of species. On the other hand, these differences are often so trivial and in some cases so transient, and the occurrence of intermediate hybrids is so common,* that the opinion is prevalent that Professor Haussknecht has described more species than are actually determinable. In the study upon which the following revision is based, I have tried as far as possible to account for all species indicated by him and other writers as coming within our limits, recognizing them as valid whenever satisfactory reason could be obtained for doing so. It is with reluctance that I publish several as new. It must be said, however, that increasing familiarity with the genus strengthens

* The very large number of communications on this subject, mainly referring to European hybrids, can hardly be touched on here. See Haussknecht's Monograph, and references in Just's Jahresbericht for nearly every year. In the descriptions of species, I have mentioned only those hybrids which from aberrant characters might be looked for elsewhere than with the species they are attributed to.

my impression that the characters here admitted as of specific value are worthy of credence, and do not apply to mere forms or varieties, although the less differentiated species fall into groups, which some of the most conservative botanists might justly treat as species consisting of fairly marked subspecies, in a monograph of the genus as a whole.

Epilobium differs from all other capsule-bearing Onagraceæ except the Californian *Zauschneria*, in having its seeds provided with an ample coma at the apex. *E. paniculatum*, which when dwarfed sometimes resembles large forms of *Gayophytum*, may therefore be distinguished by this character, as well as by its 4-celled fruit, even on superficial examination. The variety *jucundum* of the same species, which occasionally has been taken for *Zauschneria*, lacks the long colored Fuchsia-like tube above the ovary.

While it reaches great development in New Zealand, *Epilobium* is essentially a genus of temperate and cold climates, and the most widely distributed species are those of arctic and alpine regions. In Alaska a few such species occur, which are otherwise confined to the adjacent part of Asia. More widely distributed arctic-alpine immigrants from the old world are *spicatum*, *latifolium*, *palustre*, *Davuricum*, *glandulosum*, *Hornemanni*, *alpinum*, and *anagallidifolium*. The only other old world species represented in our flora are *hirsutum*, *parviflorum*, and *adnatum*, all of which are accidental waifs, the first one only having obtained even a precarious foothold in this country. On the other hand, while the genus passes into South America along the backbone of the continent, few species extend very far across the Mexican boundary in either direction.

The most interesting biological features of the genus are those connected with the means of vegetative propagation, pollination, and dissemination.

The various contrivances by which most species survive the winter and are vegetatively propagated, have been so

fully employed in the synopsis of species as to require no further description here, and it suffices to call attention to the extreme degree of differentiation that has been attained in this respect, in the genus, one species of which has acquired even ærial bulblets. The principal literature of the subject, aside from what is said in systematic descriptions, is to be found in *Barbey*, *l. c.* plates 23–24; *Beyerinck*, Nederlandsch Kruidkundig Archief, 1884 (Just, xii. 1, p. 546); *Haussknecht*, *l. c.* p. 11 & 16; *Kjellmann*, Bot. Centralblatt, 1886, No. 9, p. 291 (Just, xiv. 1, p. 924); *Mrs. Millington*, Bull. Torrey Club, x. 24; *Schmalhausen*, Erneuerungsweise einiger Epilobien, — Dissertation, St. Petersburg, 1874 (Just, ii. p. 531); and *Warming*, Bot. Tidsskrift, ii., and Om Skudbygning etc., Copenhagen, 1884, p. 84, 87, 95 (abstracts in Bot. Centralbl. xviii. and Engler's Bot. Jahrb. v. p. 65).

The only other vegetative features requiring special mention are the water glands ending the teeth on the leaves of most species (*Reinke*, Jahrb. für wiss. Bot. x. p. 143, pl. 12, f. 11); the mucilage glands at apex of very young leaves (*Oliver*, Journ. Linn. Soc. i. p. 190; *Reinke*, *l. c.* and f. 10); the anomalous nutations of the flower buds of *E. spicatum* (*Haussknecht*, *l. c.* p. 16; *Prentiss*, Bull. Torrey Bot. Club, ix. p. 8, and *Vöchting*, cited under pollination); and the supposed value of the acid cell-sap of some trichomes as a protection against the attacks of snails (*Stahl*, Jenaische Zeitschrift, xxii.).

The principal developmental studies are those by *Barcianu* in Schenk & Luerssen's Mittheilungen, ii. (Just, ii. 485), — punctum vegetationis and floral organogeny, and Sitzber. niederrh. Ges. f. Nat.- u. Heilkunde, 1873, — ovary; *Payer*, Organogen. p. 450, pl. 94, — flower; and *Warming* in Hanstein's Bot. Abhandlungen, ii. Heft 2, — anther. The stigmatic papillae are mentioned by *Behrens* in Anat. Bau des Griffels, etc., — Dissertation, Göttingen, 1875, p. 33. The pollen, which appears always to consist of tetrads, is discussed or figured by *Barbey*, *l. c.* pl. 13;

Behrens, Botanik, p. 82; *Luerssen*, Jahrb. wiss. Bot. vii. p. 46, pl. 5, f. 27–30; *Mohl*, Ann. Sci. nat., ser. 2, iii. p. 332 (the original paper published in German at Berne in 1834); *Strasburger*, Bau und Wachsthum der Zellhäute (Just, x. 1, p. 416); *Tschistiakoff*, Bot. Zeitung, xxxiii. p. 81, and Jahrb. für wiss. Bot. x. p. 7, with several plates; and *Halsted* and *McBride* in Bull. Torrey Bot. Club, 1890, p. 238.

While the larger flowered species appear to be regularly proterandrous, the duration of the dichogamy is brief in most of them, and the smaller flowered species seem to be always synacmic and self-fertile, although with the probability of frequent intercrossing by aid of insects attracted by the nectar which is secreted within the calyx tube (see *Behrens*, Flora, 1879, p. 246, and *Bonnier*, Ann. Sci. nat., ser. 6, viii. p. 115, note), and commonly protected by the dilated bases of the filaments or a nectar guard of hairs within the calyx. In *E. spicatum* the broad filaments are supplemented in this protective function by hairs on the lower part of the style. The principal publications on the pollination of the genus are as follows: *Beal*, Amer. Nat. xiv. p. 203; *Beyer*, Spontanen Bewegungen, Wehlau, 1888 (Just, xvi. 2, p. 523); *Delpino*, Alcuni Appunti, p. 19, Ulteriori Osservazione, ii. 2, p. 159, Bot. Zeitung, 1869, 810, and Malpighia, i. (Just, xv. 1, p. 318); *Gray*, Amer. Naturalist, 1876, p. 43, Amer. Agriculturist, 1876, p. 142, and Struct. Bot. p. 222; *Henslow*, Pop. Sci. Rev. 1879, p. 8; *Kerner*, Flowers and their Unbidden Guests, p. 102; *Kirchner*, Program, 68 Jahresfeier Württemb. Landw. Akad. Hohenheim, 1886 (Just, xiv. 1, p. 790), and Flora von Stuttgart, p. 412 *et seq.*; *Lubbock*, Nature, x. p. 403–5, and Brit. Wild. Fl. in rel. to Insects, index; *Müller*, Alpenblumen, p. 209, Befruchtung der Blumen, p. 189, Nature, ix. p. 165, and Weitere Beobachtungen, p. 237; *Schulz*, Bibliotheca Botanica, Heft 10, p. 35, and Heft 17, p. 73 and 118; *Sprengel*, Entdecktes Geheimniss, p. 4 and 223–224; *Thomson*, Trans. Bot. Soc. Edinburgh

xiv. p. 101; *Vöchting* Ber. Deutsch. Bot. Gesellsch. 1885 (Just, xiii. 1, p. 23 and 734), and Pringsheim's Jahrb. wiss. Bot. xvii. p. 301, pl. 16; and *Warming*, Bygningen . . . af grönlandske Blomster, Copenhagen, 1886, p. 32.—Except for the notes by Beal and Gray, these all pertain to observations made in the old world.

The development of the ovule, in some cases including the curious beak at what appears to be the apex, but is, in reality, the point at which the anatropous seed bends downward, on which the coma is inserted in many species, is more or less fully discussed by *Baillon*, Adansonia, xi. (Just, iv. p. 461); *Hildebrand*, Bot. Zeitung, 1872, 236–7, pl. 4, f. 6–8; and *Warming*, Ann. des Sci. nat., ser. 6, v. p. 238. The seed-coats are treated by *Barbey*, *l. c.* pl. 21, and *Marloth*, Engler's Bot. Jahrbücher, iv. The mechanism of the dehiscence of the capsules is described by *Beck*, Sitzber. Zool.-Bot. Ges. Wien, xxxv. p. 23 (Just, xiv. 1, p. 832); *Eichholz*, Pringsheim's Jahrb. für wiss. Bot. xvii. p. 573, pl. 35; and *Leclerc du Sablon*, Ann. Sci. nat., ser. 6, xviii. p. 66. The arrangements for dissemination are further considered by *Hildebrand*, Verbreitungsmittel der Pflanzen, p. 68, 69, 105, 135, 142: and *Chickering*, in Bot. Gazette, ix. p. 193, shows with what remarkable promptness the fire-weed, *E. spicatum*, appears over large forest areas after they had been burned off.

None of the species have any striking economic value.

ARTIFICIAL KEY TO NORTH AMERICAN SPECIES.

A. Stigma deeply 4-lobed or 4-cleft.

1. Seeds not prominently papillate, mostly smooth.

Flowers purple or pale, never yellow.

Flowers very large, opening nearly flat.

Seeds long and narrow, with persistent coma: pubescence not glandular.

Leaves with very evident looped veins: bracts small: style pubescent at base...*E. spicatum.*

Veins inconspicuous, rarely looped: bracts leafy: style glabrous.....*E. latifolium.*

Seeds broad: ovary soft-glandular: bracts reduced, ...*E. rigidum.*

Flowers smaller, less open: seeds short and broad, with easily falling coma.....*E. paniculatum.*

Flowers bright yellow, large but not opening widely: leaves broad, toothed, glabrous.....*E. luteum.*

2. Seeds papillately roughened under the microscope.

Flowers cream-colored, smaller: leaves narrow, entire, canescent.....*E. suffruticosum.*

Flowers purple or pale, never yellow.

Hirsute or tomentose with long spreading white hairs, ...*E. hirsutum.*

Glabrous, canescent, or short glandular.

Flowers very large and open: plants rather low, perennial, nearly simple above: leaves broad.

Leaves acute at both ends, entire.....*E. rigidum.*

Leaves rounded at base, repand-toothed, *E. obcordatum.*

Flowers less open: plants tall, dichotomous or panicled: leaves elongated.....*E. paniculatum* and var. *jucundum.*

E. exaltatum (cf. *adenocaulon*), *E. Oreganum* (cf. *glaberrimum*), and another supposed hybrid, which is mentioned under *Hornemanni*, would be looked for under *A*, because of their stigmatic characters.

B. Stigma entire or only notched: flowers never yellow.

1. Seeds not prominently papillate, mostly smooth.

Seeds broadly obovoid, very blunt: coma easily falling: leaves subpetioled, narrow, acute.

Glabrous or glandular, dichotomous: leaves mostly veined, often incurved or folded along the midrib: seeds very large (1x2 mm.).....*E. paniculatum.*

Crisp-pubescent, simple or panicled: leaves mostly veinless: seeds half as large.....*E. minutum.*

Seeds fusiform: coma more persistent.

Leaves minutely revolute, ...smoother seeded forms of the group of *E. palustre.*

Leaves not revolute: stem simple or few branched below.

Leaves rather ample, ovate to elliptical, some of them usually toothed. (*E. glandulosum*, with seed papillæ collapsed, might be sought here.)

Glandular-pubescent: leaves sessile, some of them broadly decurrent: seeds very long, blunt at base, tapering above into a broad pale apex, ...*E. Halleanum.*

Crisp-pubescent in lines: leaves not decurrent: seeds shorter, more acute below, with narrower sometimes very short and abrupt beak.

Alaskan species with rosy flowers.

Erect: leaves elliptical, tapering to each end, petioled; flowers nodding.....*E. Bongardi.*

Ascending at base: leaves ovate, the upper sessile; flowers erect.....*E. Behringianum.*

Extending southward in the mountains: stems ascending at base: leaves petioled.

Flowers violet, medium sized: leaves dark green or purple: seeds blunt above, . . . exceptionally smooth-seeded plants of .....*E. Hornemanni.*

Flowers white, very small: leaves thin, light green: seeds (seen from in front) gradually attenuated to the beak.....*E. alpinum.*

Leaves quite small, usually nearly entire.

Stem ascending or almost creeping, often S-shaped, cespitose: leaves relatively broad and spreading, uniformly distributed,.....*E. anagallidifolium.*

Stem erect, not cespitose: leaves strict, the uppermost remote and linear.....*E. Oregonense.*

2. Seeds papillately roughened under the microscope.

a. Leaves linear to lanceolate, nearly entire, generally without conspicuous lateral veins.

Leaves slightly revolute: sobols filiform, at length ending in large turions: seeds large, elongated.

Simple or nearly so, crisp-pubescent: leaves sessile, usually obtuse.....*E. palustre.*

Mostly branched above; leaves more acute.

Crisp-pubescent: leaves very narrow, petioled, ...*E. lineare.*

Softly white-glandular: leaves lanceolate, sessile, ...*E. strictum.*

Leaves not revolute, sometimes involute in *paniculatum.*

Innovations and seeds as in the last group, ...hybrids of *E. palustre.*

Innovations various, never filiform.
Rosuliferous, unbranched, not cespitose: leaves very blunt, crowded below: seeds as in the last group.....*E. Davuricum.*
Annuals, with broad obovoid seeds and very deciduous coma.
Dichotomous, glabrous or glandular: seeds large (1x2 mm.).....*E. paniculatum.*
Simple or panicled, crisp-pubescent: seeds half as large.....*E. minutum.*
Turioniferous: coma more persistent. Small plants.
Branched: leaves small, acute, petioled: coma reddish.....*E. leptocarpum*
Simple, or sometimes branched below in the first and cespitose in the last: leaves sessile or subsessile: seeds broader, with pale coma.
Tomentose throughout and somewhat pilose.....*E. ursinum*, var. *subfalcatum.*
No long hairs: glabrous below or crisp-pubescent in lines only.
Not cespitose: pubescence scanty: leaves obtuse, drying light, the upper nearly linear..*E. delicatum*, var. *tenue.*
Often cespitose: quite glandular above, even as to the subacute leaves which dry dark.....*E. saximontanum.*
Soboliferous and cespitose, glaucous: seeds broad, ...*E. glaberrimum.*
Cespitose by stolons, very slender-stemmed, not pilose, occasionally glaucous in the first: seeds elongated.
Leaves erect, narrow, keeled below, ...*E. Oregonense*, var. *gracillimum.*
Leaves more spreading, broader, not keeled, ...*E. clavatum.*

b. Leaves lanceolate to ovate, evidently toothed, veiny (or often subentire and less veiny in the last three), not revolute.
Dichotomous, annual: pubescence not crisp: leaves slender-stalked, acute: seeds very broad and obtuse, ...*E. paniculatum.*
Simple or nearly so, apparently annual: pubescence crisp,.....dwarf form referred to *E. adenocaulon.*
Rosuliferous: not glaucous: leaves with at least short winged petioles.
Flowers large for the group, the violet petals 6 to 10 mm. long. Pacific species.
Stem subtomentose, little branched: leaves elliptical, obtuse: flowers protruding beyond the terminal leaves .....*E. Watsoni.*

Glabrate below, more branched: leaves ovate-lanceolate, the upper acute.
Leaves crowded above: flowers hardly surpassing the uppermost leaves: glandular pubescence coarse and dingy above.....*E. Franciscanum.*
(Young *glandulosum* and *boreale* might be sought here.)
Leaves more remote: flowers conspicuously protruding: pubescence fine, sometimes incurved,
.....*E. adenocaulon*, var. *occidentale.*
Flowers smaller, the petals 3 to 5 mm. long.
Seeds obconical, beakless, 1.5 mm. long: coma reddish: leaves lanceolate, acute, sharply serrulate.....*E. coloratum.*
Seeds nearly ellipsoidal, about 1 mm. long, short-beaked at summit: coma white or pale.
Leaves narrowly lanceolate.
Much branched: leaves often obtuse, not deeply serrulate, at least the uppermost and the twigs silky.....*E. holosericeum*
Little branched: leaves acute, sharply toothed, glabrate.....*E. Fendleri.*
Leaves broader, elliptical to ovate-lanceolate.
Sharply toothed: flower buds crisp-pubescent.
Southwestern: leaves elliptical, obtuse.....*E. Novo-Mexicanum.*
Northwestern and Pacific: leaves ovate- to triangular-lanceolate: pubescence chiefly glandular,
.....*E. adenocaulon.*
Alaskan: leaves broadly lanceolate, acute: pubescence crisp..*E. boreale.*
Less deeply and sharply toothed: petioles frequently very short in the first.
Pubescence fine, short-glandular (or in some forms somewhat crisp),
.....*E. adenocaulon.*
Pubescence not glandular, somewhat divergent above in the second.
Finally much branched: lower leaves obtuse: pubescence short and subtomentose on flower buds...*E. Parishii.*
Little branched: leaves acute, thin and elongated: pubescence of buds coarse, somewhat spreading,
.....*E. Californicum.*

Turioniferous plants only exceptionally branching, not glaucous.
Leaves petioled, small and spreading,
.....*E. leptocarpum*, var. *Macounii*.
Leaves frequently petioled, ample.
Alaskan: branching, leafy: leaves serrate, drying dark .....*E. boreale*.
Of the Columbia region: simple, less leafy: leaves low-denticulate, light green .....*E. delicatum*.
Leaves sessile (or subpetioled in *saximontanum* if looked for here, and as to occasional leaves of *brevistylum*).
Some leaves clasping-decurrent: stem mostly simple: seeds obtuse below, gradually tapering above into a broad pale beak.....*E. Halleanum*.
Leaves not decurrent: seeds acute below, more abruptly short-beaked.
Leaves medium-sized: petals about 5 mm.: seeds rather acute at top.
Pubescence long and spreading below,
.....*E. ursinum*.
Pubescence not pilose.
Leaves narrow, typically erect, acute,
.....*E. Drummondii*.
Leaves ovate-lanceolate, acute: stem very crisp-pubescent above,..young *E. boreale*.
Leaves ovate, more obtuse, drying pale: pubescence scanty.....*E. brevistylum*.
Leaves ample, broadly ovate, the upper often exceeding the inflorescence, drying dark: petals about 7 mm.: seeds obtuse at top...*E. glandulosum*.
Soboliferous, ascending at base, at length often cespitose or with sterile basal shoots.
Glaucous, without pubescent lines: leaves subsessile, ..broad-leaved *E. glaberrimum*, and its var. *latifolium*.
Not glaucous, crisp-pubescent in lines: leaves evidently petioled, rather thin.....*E. Hornemanni*.
Stoloniferous, ascending at base, quite cespitose: leaves small for the group, often nearly sessile, firm,
.....*E. clavatum*.

SYNOPSIS OF NORTH AMERICAN SPECIES.

§ 1. *Chamænerion.* — **Calyx cleft almost to the ovary: corolla slightly irregular, the petals usually entire, widely expanding, their margins scarcely meeting: stamens inserted in a single series, the filaments dilated below: style at first recurved: stigma with 4 ultimately divergent lobes: capsule mostly linear-fusiform, many-seeded: seeds fusiform, beakless, not papillate in our species. — Cespitose perennials from a stout caudex bearing sessile scaly winter buds, with terete stems scaly below, and ample leaves; our species more or less canescent but not glandular.**

1. E. SPICATUM, Lam. — Mostly a couple of feet high, subsimple, glabrate below; leaves as much as 150 mm. long, alternate, lanceolate, acute, nearly entire, very short-stalked, paler below, thin, pinnately veined with the evident lateral veins confluent in submarginal loops; inflorescence elongated, racemose, with small bracts; young flower-buds soon reflexed but again spreading or ascending before expansion; petals 10 to 15 mm. long; style exceeding the stamens, hairy at base; capsules 50 to 75 mm. long, from subsessile to long-stalked; seeds .4 x 1.4 mm., with very long dingy coma. — Fl. Fr. iii. (1778), 482; Watson, Index, 366. — *E. angustifolia*, β. L. Sp. 347. — *E. angustifolium*, Hausskn. Monogr. 37, and many writers. — Usually on hillsides, railroad embankments, etc., Labrador to Alaska, south to the mountains of North Carolina, Illinois, New Mexico, and the hills of southern California; also in Greenland, Europe and Asia. — Specimens examined from Maine, New Hampshire, Massachusetts, New York, New Jersey, Delaware, Ohio, Michigan, Illinois, Wisconsin, Nebraska, New Mexico, Utah, Colorado, Montana, Arizona, Nevada, California, Oregon, Alaska, and various parts of Canada and British America. — Plate 1.

Varying much in breadth of leaves, length of capsule, and degree of canescence. An albino with more than usually canescent pods is var. *canescens*, Wood, Class Book, 2 ed., 262, which is essentially the forma *albiflora* of Haussknecht, Monogr. 38, and Britton, Cat. Pl. N. J., 108. Lux-

uriant specimens collected in Alaska by Harrington, in 1872, have leaves 40 mm. wide, bracts leafy, and the style storter than the stamens but hairy at base.

Though Professor Haussknecht adopts the Linnean name for this species, it appears wiser to use that proposed by Lamarck, the typical *angustifolium* of Linnæus being according to him what is commonly known as *E. Dodonæi*, Vill.

2. E. LATIFOLIUM, L. — A span to usually a foot or more high, frequently branched, mostly glabrate below; leaves rarely 50 mm. long, usually opposite and connected below on the branches and rarely on the main stem, lanceolate to ovate, acute at both ends, entire or sparingly and minutely denticulate, scarcely petioled, pale, rather coriaceous, the mostly free lateral veins inconspicuous; inflorescence usually short and few flowered, leafy throughout, the buds not reflexed; petals 15 to 30 mm. long, rather narrow; style shorter than the stamens, glabrous; capsules sometimes short and stout; seeds .5 x 2 to 2.5 mm.; otherwise like the last. — Sp. i. (1753), 347; Watson, Index, 365; Haussknecht, Monogr. 190. — Damp places, Arctic America from Labrador to Alaska, extending southward to Canada (*Allen*), the mountains of Colorado, and N. E. Oregon. Also in the arctic regions of the Old World, extending in Asia to the Himalayas. — Specimens examined from Labrador, Canada, Repulse Bay (*Hall*), Grinnell Land (*Greely*), Montana, Colorado, Union Co. Oregon (*Cusick*), British Columbia, Alaska, and the islands of Bering Strait. — Plate 2.

Our plants belong to the less hairy and more glaucous form. The name was originally spelled *latifolia* by Linnæus. Plants from a high latitude are usually larger-flowered, with broad petals, constituting the variety *grandiflorum*, Britton.

§ 2. *Lysimachion.* — Calyx with an evident though usually short tube mostly somewhat hairy within: corolla regular, the petals deeply notched or obcordate, usually not expanding beyond funnel form, their margins then overlapping: stamens inserted in two more or less distinct whorls, those opposite the sepals longer and more deeply inserted: style not declined, mostly glabrous.

* Stigma 4-cleft: seeds beakless. — Perennials with rather slender caudex or root-stock and usually terete stems (somewhat quadrangular in *suffruticosum*, and with decurrent lines in *luteum*). — From the stigmatic characters, *E. exaltatum* and *E. Oreganum* might be looked for here.

+ Capsules linear-fusiform, as much as 75 mm. long, many-seeded: seeds beakless. — Rather tall plants with ample conspicuously veined chiefly opposite leaves, and large flowers with short and open calyx-tube.

E. HIRSUTUM, L. — Spreading by long subterranean shoots at length bulbiferous or rosuliferous at end, mostly a couple of feet high, with ascending branches, hirsute with soft white hairs; leaves as much as 75 mm. long, oblong-lanceolate, acute, prominently serrulate, sessile and frequently clasping-decurrent, thin but not very veiny; flowers rather abundant in the upper axils, erect; petals rose-purple, 10 to 15 mm. long, hairy at base within; style included; capsules short stalked; seeds oblong, densely papillate, .5 x 1.1 mm., with pale coma. — Sp. i. (1753), 347; Watson, Index, 365. — Waste grounds at various points on the Massachusetts and Rhode Island coast, and in the interior of New York and Ontario. — A European plant doubtfully established in this country. — Plate 3.

E. PARVIFLORUM, Schreber, an old world species of the pubescence and habit of the preceding, but rosuliferous at base and with very much smaller flowers, has been collected on ballast at Hoboken, N. J., by Hon. Addison Brown, but does not belong to our flora. It has also been reported as *E. pubescens*, Roth.

3. E. LUTEUM, Pursh. — A foot or two high, nearly simple, glabrate below except along the elevated lines decurrent from some of the nodes; leaves 25 to 75 mm. long, ovate or elliptical to broadly lanceolate, acute or acuminate, sinuate-toothed, sessile or when large obliquely tapering to winged petioles, slightly fleshy, rather pale; inflorescence more or less incurved- or glandular-pubescent, the flowers at first nodding, not very numerous, in the axils of the somewhat crowded and frequently reduced upper leaves; petals bright yellow, 15 to 18 mm. long;

style frequently exserted, its obconical apex mostly deeply 4-parted; capsules long-stalked, more or less puberulent; seeds obovoid, very acute at base, smooth or slightly areolated, .5 x 1.25 mm.; coma at length reddish. — Fl. i. (1814), 259; Watson, Index, 365; Haussknecht, Monogr. 245; Barbey & Cuisin, pl. 1. — Oregon to Alaska and the islands of the Northwest, east to the Selkirk Range of British Columbia. Also in eastern Siberia, *fide* Ledebour. — Specimens examined from Alaska, Washington, Oregon, and the Selkirk Range (*Macoun*).

+ + Capsules rather short, subclavate-fusiform, fewer-seeded. — Rather low and slender-stemmed more or less cespitose plants, with bark usually somewhat papery-exfoliating at base.

+ Leaves rather broad: flowers large, rose-purple: style shorter than the petals: seeds oblong-fusiform, papillate (except in the first?).

4. E. RIGIDUM, Hausskn. — A span or two high, subsimple, glabrous and rather glossy at base, glandular-pubescent above; leaves about 40 mm. long, the upper more or less alternate, lanceolate to nearly obovate, acute, entire, frequently oblique, cuneately narrowed into short winged petioles, glabrous and very glaucous, firm, with mostly inconspicuous lateral veins; flowers rather few in the axils of the reduced upper leaves which are often adnate to the bases of the peduncles; ovary densely white-glandular; calyx cleft to within 1 mm. of the base, open; petals 15 to 20 mm. long; stigma very large, its surface pilose-papillate; seeds (immature) apparently smooth. — Oesterr. bot. Zeitschr. xxix. (1879), 51; Monogr. 249, pl. 13, f. 64. — Southern Oregon: Coast Range, lat. 42° (*fide* Haussknecht); Waldo (*Howell*, July 1888, distributed as No. 698). — Plate 5.

Var. CANESCENS. — Densely velvety-canescent throughout. —Waldo, Oregon (*Howell*, July 12, 1887, No. 698).

5. E. OBCORDATUM, Gray. — About a span high, considerably branched near the base and sometimes with long

sparingly leafy decumbent branches, glabrous or with glandular inflorescence; leaves 15 to 20 mm. long, all opposite, elliptical to ovate, obtuse, remotely repand toothed, abruptly rounded to short winged petioles, typically very glaucous with inconspicuous lateral veins but drying rather thin; flowers few, often slender-peduncled, in the axils of the scarcely reduced upper leaves; calyx-tube cylindrical to funnel-form, 2 to 4 mm. long; petals about 15 mm. long; capsules less clavate, about 30 mm. long, equalling or exceeding the very slender peduncles; stigma only half as large as in the last, with short papillæ; seeds .5 x 1.5 to 1.7 mm., finely papillate; coma white or dingy. — Proc. Amer. Acad. vi. (1865), 532; Watson, Index, 365; Haussknecht, Monograph, 250, pl. 15, f. 69; Barbey & Cuisin, pl. 3. — Central California, and in the East Humboldt Mountains of Nevada (*Watson*). — Plate 6.

†† †† Leaves relatively narrower: flowers smaller, cream-colored: style exserted: seeds nearly obconical, closely low-papillate.

6. E. SUFFRUTICOSUM, Nutt. — More woody and intricately much branched at base, a span high, minutely canescent throughout or at length glabrate below; leaves numerous, under 20 mm. long, mainly opposite, broadly lanceolate, acutish, entire, cuneately narrowed but hardly petioled, thick, with inconspicuous veins; flowers rather few in the axils of the scarcely reduced upper leaves; calyx-tube broadly funnel-form, about 3 mm. long; petals 5 to 8 mm. long; capsule 25 mm. long, short-stalked; seeds .8 to 1 x 2.3 to 2.5 mm.; coma long and very dingy, readily falling. — Torr. & Gr. Fl. i. (1840), 488; Watson, Index, 367; Haussknecht, Monogr. 250, pl. 13, f. 63; Coulter, Rocky Mt. Botany, 102; Barbey & Cuisin, pl. 4. — Oregon (*Nuttall*) to northwestern Montana and the Yellowstone Park. — Plate 7.

* * Stigma more or less 4-cleft in the larger flowers, usually subentire in the smaller: capsules prominently ribbed, rather short and few seeded: seeds beakless, very broad and blunt, usually abruptly con-

tracted above the base, areolate or low-papillate: coma pale, falling easily.— Mostly slender annuals with terete stems more or less glandular-pubescent above and with somewhat exfoliating bark at base, and rather firm nearly veinless leaves except in broad-leaved forms of *paniculatum*.

7. E. PANICULATUM, Nutt.— A foot or two high, loosely dichotomous, mostly glabrate at base; leaves 30 to 50 mm. long, chiefly alternate and fascicled in the axils, lanceolate or linear-lanceolate, often somewhat folded along the midrib, acute, rather sparingly denticulate, tapering to a slender winged base, gradually passing into the smaller bracts; flowers rather remote, toward the ends of the ascending branches, erect, the bracts often carried up on their peduncles; calyx-tube very narrowly funnel-form, 3 to 6 mm. long; petals about 8 mm. long, violet; capsules fusiform, falcate, ascending, about 20 mm. long; seeds 1 x 2 mm., low papillate. — Torr. & Gr. Fl. i. (1840), 490; Watson, Index, 366; Haussknecht, Monogr. 246, pl. 2, f. 27; Barbey & Cuisin, pl. 8; Coulter, Rocky Mt. Bot. 102. — San Diego county, California, to Vancouver Island, Arizona and Colorado, extending eastward through British America to the Canadian shore of Lake Huron (*Macoun*).— Specimens examined from Vancouver Island and various points in the Rocky Mountains of British America, Washington, Oregon, California, Nevada, Arizona, Utah, Colorado, Idaho, and Montana, as well as the Lake Huron specimen of Macoun. — Plate 8.

Quite variable in robustness, length of calyx-tube, size of flowers (sometimes not over 3 mm. long) and leaves, and in the staring pubescence, which sometimes stops abruptly a short distance below the ovary, while some specimens are perfectly glabrous and others very glandular throughout.

Var. JUCUNDUM (Gray). — Usually somewhat glaucous, less dichotomous, and with shorter and more thyrsoid inflorescence; leaves rather firmer; petals as much as 20 mm. long and rather widely expanding, deep violet; style frequently exserted; capsules erect and mostly crowded: otherwise like the type, which almost passes into it through

the larger-flowered forms — *E. jucundum*, Gray, Proc. Amer. Acad. xii. (1876), 57; Barbey & Cuisin, pl. 11. — *E. paniculatum*, β. *tubulosa*, Haussknecht, Monogr. 247. — California: Sierra and Siskiyou counties (*Greene*) and Plumas county (*Mrs. Ames*), to Washington (*Pringle, Suksdorf*). — Plate 9.

8. E. MINUTUM, Lindl. — A span or two to occasionally a foot or more high, simple or mostly with ascending branches throughout, crisp-pubescent below; leaves under 20 mm. long, usually alternate except in small specimens, narrowly to broadly lanceolate or the lowest spatulate, acutish, undulate, cuneately narrowed to the slender winged base, the uppermost scarcely bract-like; flowers rather numerous, distributed along the stem, erect; calyx-tube broadly funnel-form, short; petals 3 to 4 mm. long, violet or pale; capsules arcuate-ascending, about 25 mm. long, much narrowed to the base, short-stalked; seeds .3 to .5 x .7 to 1 mm., reticulated or low-papillate. — Hooker, Flor. Bor.-Amer. i. (1833) 207; Watson, Index, 365; Haussknecht, Monogr. 248; Barbey & Cuisin, pl. 7. — California to Vancouver Island, east to Lake Athabasca (*Macoun*). — Specimens examined from California, Oregon, Washington, Vancouver Island, and various points in British Columbia. — Plate 10.

Var. FOLIOSUM, Torr. & Gr. Fl. i. (1840), 490, is a form of the general distribution of the species, with narrow leaves much fascicled in the axils. — Specimens examined from Guadelupe Island (*Palmer*, 31), and the regions named.

While the stigma varies from nearly peltate or capitate and subentire to somewhat 4-lobed, the fimbriation which led Spach (Monogr. Onagr. 1835, 84; Ann. Sci. nat., 2 ser. iv. 174) to create for this species the genus *Crossostigma*, is not evident in any specimen studied by me. It may possibly refer to the torn pollen tubes frequently observable on old stigmas from which the germinated pollen has been rubbed away.

*** * * Stigma clavate, entire or but slightly notched: coma of seeds mostly persistent. — Plants of various habit, perennial by rhizomes, stolons, turions, etc. (Exceptions are *E. exaltatum* and *E. Oreganum*, both of which have conspicuously 4-lobed stigmas.)**

+ Spreading by filiform remotely scaly subterranean shoots, which end in ovoid winter bulblets with fleshy scales: capsules linear-fusiform, many seeded: seeds more or less papillate, mostly fusiform, with conspicuous translucent beak at insertion of coma. — Generally slender plants with terete stems (or these with slightly prominent or pubescent lines in *palustre*), narrow minutely revolute leaves entire or rarely very remotely and obscurely denticulate, and small rosy or white flowers with short funnel-shaped calyx-tube.

++ A foot or two high, usually corymbose above, especially in the typical form of the second: leaves numerous, ascending, chiefly alternate except the lowest, cuneately short petioled in the second only: flowers numerous, erect, in the upper axils: coma somewhat dingy.

9. E. STRICTUM, Muhl. — Pubescent throughout with soft spreading white hairs; leaves 25 to 40 mm., rather obtuse, with evident lateral veins; petals 4 to 7 mm. long; capsules 50 to 75 mm., much exceeding their peduncles; seeds .4 to .5 x 1.8 mm., nearly obconical, more prominently papillate than those of the following two species. — Catal. (1813), 39, with no description other than the word "soft," referring to the very characteristic pubescence; Sprengel, Syst. ii. (1825), 233, with description; Haussknecht, Monogr. 254. — *E. molle*, Torr. Fl. U. S. (1824), 393, but not Lamarck; Watson, Index, 365; Barbey and Cuisin, pl. 12 (the text as *E. strictum*, Muhl). — Bogs, New England, Canada West, and Minnesota, to Illinois and Virginia. — Specimens examined from various points in Canada, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, New York, New Jersey, Pennsylvania, Virginia, Ohio, Illinois, Michigan, Wisconsin, and Minnesota. — Plate 11.

10. E. LINEARE, Muhl. — Canescent throughout with short incurved hairs; leaves as long as in the last, linear-lanceolate, acute, without evident lateral veins; petals 3 to 5 mm. long; capsules 50 mm., often on long slender peduncles; seeds fusiform, .4 x 1.5 mm. — Cat. (1813), 39, with

no description further than the expression "linear-leaved;" Barton Comp. Fl. Philad. i. (1818), 183; Hausskn. Monogr. 255, pl. 2, f. 25. — *E. palustre*, var. *lineare*, Gray, and Watson, Index, 366. — Bogs, New Brunswick to the Selkirk Range (*Macoun*), south to the Yellowstone Park, Indian Territory, Illinois, and Delaware.—Specimens examined from Prince Edward's Island and various parts of Canada and British America, Maine, New Hampshire, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Ohio, Illinois, Wisconsin, Kansas, Indian Territory (*Bigelow*), Nebraska, and the Yellowstone region. The specimens on which Haussknecht extends the range of *lineare* to Oregon doubtless belong to the next species. — Plate 12. — Specimens with more lanceolate leaves with evident lateral veins, occasionally occur, even in regions where *E. palustre* is not found, so that they can scarcely be looked on as hybrids.

Var. OLIGANTHUM (Michx.), (*E. oliganthum*, Michx. in part), of the middle Atlantic region, a simple few-flowered form with the opposite leaves more obtuse and less evidently petioled, may perhaps be distinguished.

If the custom of replacing Muhlenberg's names, owing to incomplete description, should ever become prevalent, the very descriptive name *E. densum*, Raf. Desv. Journ. de Bot. ii. (1814), 271, may come to replace the one here employed for this species.

↔↔ A span to a foot high, usually simple, rather less woody: leaves fewer, suberect, chiefly opposite, evidently veined, gradually narrowed to a sessile base: flowers few, mostly nodding at first: coma paler.

11. E. PALUSTRE, L. — Quite canescent above with incurved hairs; leaves 25 to 50 mm. long, narrowly oblong or exceptionally lanceolate, obtuse or almost truncate; fruiting peduncles often long and slender; seeds fusiform, .4 to .5 x 1.5 to 2 mm., with prominent scarcely narrowed translucent apex. — Sp. i. (1753), 348; Watson, Index, 366; Haussknecht, Monogr. 128. — Swamps and wet places,

New Brunswick to Alaska and the northwestern islands, south to lower Canada, the mountains of Colorado, and Washington; also in Europe and Asia, extending into India: — a boreal plant, so far as our continent is concerned. — Specimens examined from many parts of Canada and British America, Alaska, Bering Straits, Washington (*Suksdorf*, 1881, as *E. coloratum*), and Colorado. — Plate 13.

Forma *Labradorica*, Hausskn. — A span or two high; leaves oblong-lanceolate to broadly lanceolate, more divergent; flowers solitary or few, very nodding. — Monogr. 131. — Wet places and bogs, Labrador to the White Mountains of New Hampshire, in the former locality, especially, passing into the usual western form. — Plate 13.

E. anagallidifolium, so far as the Eastern States are concerned, seems to rest upon this form, which in a dwarfed state considerably resembles it, but may always be recognized by its revolute leaves, very cinereous inflorescence, long, papillate seeds, and (when obtainable) filiform bulbiferous shoots.

+ + Innovations unknown: habit of *E. palustre*, but the leaves more alternate, sparingly toothed, and not revolute: seeds obovoid, beakless, slightly papillate.

E. PSEUDO-LINEARE, Hausskn. — Slender-stemmed, firm, a span to a foot high, pubescent with very short subappressed hairs; leaves as much as 20 mm. long, linear, abruptly callous-pointed, mostly prominently undulate-toothed, sessile, cinereous on both faces, rather thick and firm and without conspicuous lateral veins; petals 6 mm. long, purple; capsules 60 mm., slender, on rather long slender peduncles; immature seeds obovoid, rounded at top, .5 x 1 mm. — Monogr. 253, pl. 16, f. 73. — California, at the Russian Settlement (specimen in Hb. Petropol.), *fide* Haussknecht.

Unknown to me, and suspected by Professor Haussknecht to be a hybrid of uncertain parentage.

+ + + Producing at base of stem in late summer and autumn, rosettes of foliage leaves, sessile or ending short scaly shoots: leaves not revolute, more or less toothed: seeds papillate.

++ Habit of *E. palustre:* stems terete or with occasional low decurrent lines: seeds fusiform, prominently beaked.

12. E. Davuricum, Fischer. — A span or two high, mostly simple, the very slender stem sparingly incurved-pubescent, otherwise glabrous; roots densely fascicled; leaves less than 15 mm. long, somewhat crowded at base, alternate and remote above, linear or oblong, obtuse, remotely denticulate, sessile, 1-nerved; flowers pale, not very numerous, nodding; capsules erect, 40 mm., on long slender peduncles; seeds .4 x 1.5 mm.; coma white. — Hornem. Suppl. Hort. Bot. Havn. (1819), 44; Haussknecht, Monogr. 145, pl. 2, f. 23 and 36. — Bogs, Alaska to Washington (*fide* Haussknecht), east to the Selkirk Range of British America (*Macoun*). A Siberian plant. — Plate 14.

In one of Professor Macoun's specimens the beak of the seed is very narrow and .3 mm. long.

++ ++ Coarser, branched plants, of the habit of *E. coloratum:* stems with rather prominent ridges decurrent from some of the leaves (or these more or less evanescent in *holosericeum*): leaves usually ample, commonly toothed, and with evident lateral veins: capsules 40 to 50 mm. long: seeds mostly broadly obovoid, short-beaked, sharply papillate in rather distinct longitudinal lines, (finely papillate in *holosericeum*, nearly obconical and beakless in *coloratum*, and more fusiform in *Fendleri*).

= Large flowered for the group, with rather deep violet petals 6 to 10 mm. long: hairs within calyx-tube well developed: leaves mainly opposite, 25 to 50 mm. long. — Two species closely related to *E. adenocaulon.*

13. E. Franciscanum, Barbey. — A span to mostly a foot or two high, the larger forms much branched, glabrate below, subcanescent or more or less pilose above; leaves elliptical-lanceolate to ovate-lanceolate, obtuse, with rather numerous and prominent serrations, rounded to the very short and broad petioles, the uppermost frequently pilose along the midrib, etc.; flowers at first crowded, scarcely exceeding the somewhat reduced leaves clustered at end of branches; seeds broad, very hyaline-papillate, .4 to .5 x 1 mm., the short beak also more or less papillate; coma sometimes tawny. — Brewer & Watson, Bot. Calif. i. (1876), 220; Haussknecht, Monogr. 262; Barbey & Cuisin, pl. 12.—

Esmeralda county, Nevada (*Shockley*), western central California, and Oregon (*Hall*, and *N. W. Bound. Surv.*). — Plate 15.

The larger, more glabrous and compound form, figured by Barbey & Cuisin, approaches the usual Pacific variety of *adenocaulon*, the flowers of which are sometimes rather large but more loosely arranged. Specimens collected by Macoun on Vancouver Island and in the Rocky Mountains of British Columbia, are doubtfully referred here, though they may belong to *adenocaulon*. The smaller, more closely crisp-hairy form approaches the next species, and is well represented by *Hall*, no. 177 *a*, from Oregon. A curious simple plant with large glossy thin leaves, scarcely to be referred elsewhere, occurs from Queen Charlotte's Islands, B. C. (*Dawson*, July 10, 1878, no. 1932 in hb. Macoun.)

14. E. WATSONI, Barbey. — Becoming a foot and a half high, with less marked lines, softly crisp-downy throughout; leaves elliptical, rather obtuse, slightly denticulate, rounded to short winged petioles; flowers not very numerous, suberect, in the axils of the gradually reduced more lanceolate and acute upper leaves; seeds coarsely papillate, .3 x 1.25 mm., barely umbonate at top; coma dingy. — Brewer & Watson, Bot. Calif. i. (1876), 219; Haussknecht, Monogr. 263; Barbey & Cuisin, pl. 6. — Various parts of California, *fide* Haussknecht. — Known to me with certainty only in the original specimens in Hb. Gray. from the Russian settlement, but young plants from Mariposa county (*Congdon*, 1890) can hardly be referred elsewhere. What commonly passes for this is the preceding species. — Plate 16.

= = Petals 3 to 5 mm. long, pale to mostly rather deep rose-colored: leaves for the most part alternate: otherwise like the preceding group.

***a*. Narrow-leaved for the group.**

15. E. HOLOSERICEUM, n. sp. — Rather woody, loosely branched, at least the upper leaves and branches canescent with subappressed hairs; leaves 50 mm. long, rather re-

mote and smaller on the flowering branches, oblong-lanceolate, obtuse or exceptionally acute, undulately low-serrulate, narrowed or abruptly contracted and then cuneately narrowed into short petioles; flowers produced in long succession along the elongated branches, erect, pale, barely 5 mm. long; fruiting peduncles about 10 mm. long and equalling the leaves; seeds short-beaked, very finely papillate, .4 x 1 mm.; coma white or somewhat dingy. — California: San Bernardino county (*Parish*, 1881, no. 1022) and Kern county (*Heermann*, Aug. 1853, in Hb. U. S. Dep. Agr.). Possibly also Mariposa county (*Congdon*, 1882).— Plate 17.

Innovations have not been seen by me, and Mr. Parish considers the plant to be probably annual. In pubescence it most nearly approaches *E. Watsoni*, while the rosy flower-buds are somewhat as in *E. Californicum*.

E. ADNATUM, Griseb. (*E. tetragonum* of most old world writers, but not of Linnæus nor of American botanists), a large European species collected on ballast near Philadelphia (*Martindale*, June 1878, in Hb. U. S. Dept. Agr.), is related to the last in being pubescent above with short closely appressed straight white hairs, and in having its rather acute sharply serrulate leaves typically oblong with nearly parallel margins; but it differs from all of our rosuliferous species in that some of the leaves are broadly sessile with the margins decurrent on the stem into prominent subglabrous lines. Its seeds are very rough.

16. E. FENDLERI, Hausskn. — Slender, virgate, little branched, the inflorescence and flowers cinereous with incurved hairs; leaves 25 to 75 mm. long, narrowly lanceolate, acute, rather sharply low-serrulate, gradually narrowed to very short winged petioles; seeds with very short scarcely pellucid beak, .3 x 1 mm.; coma white.— Monogr. 261.— New Mexico (*Fendler*, no. 217 in part, *fide* Haussknecht; *Wright*, 1851, no. 1065 in part, and 1849, no. 953,— in Hb. Gray., not distributed). — Plate 18.

b. Broader-leaved, the foliage often purple in autumn.

17. E. COLORATUM, Muhl. — Glabrate below, the rather numerous panicled branches canescent with incurved hairs at least along the decurrent lines, and more or less glandu-

lar towards the end; leaves 50 to 150 mm. long, lanceolate to oblong-lanceolate, acute, deeply and irregularly serrulate, mostly gradually narrowed to conspicuous slender petioles, glabrous except the uppermost, dull, thin, rugose-veiny; flowers very numerous, more or less nodding; petals 3 to 5 mm. long, rosy; fruiting peduncles slender, mostly short; seeds obconical-fusiform, beakless, strongly papillate, .3 x 1.5 mm.; coma at length cinnamon-colored, at least at base. — Willd. Enum. i. (1809), 411; Hausskknecht, Monogr. 258; Barbey & Cuisin, pl. 9. — Wet ground and meadows, Canada to South Carolina, west to Wisconsin, Nebraska, and Missouri. — Specimens examined from Ontario, Maine, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Virginia, South Carolina (*Ravenel*), West Virginia, Ohio, Illinois, Missouri, Kansas, Nebraska, Iowa, and Wisconsin. — Plate 19.

This species, the general type of which is reproduced in a number of others which here follow it essentially in the order of their leaf and habit resemblance, differs from all of its congeners in the degree of serration of its leaves and especially in its elongated seeds destitute of the usual apical beak, and from all with which it is likely to be confounded, in the nearly cinnamon-colored ripe coma (which, however, is white in immature capsules that have dehisced while drying). It is apparently everywhere associated with *E. adenocaulon*, which begins to flower and fruit about a fortnight earlier, and differs in its very short-stalked leaves, rounded at base and less sharply toothed, and in its shorter seeds abruptly contracted and hyaline-beaked above, and with pure white coma. West American specimens which have been called *E. coloratum* belong, for the most part, to forms of *adenocaulon*.

18. E. Novo-Mexicanum, Hausskn. — With upcurving branches throughout, glandular-pubescent or subcinereous above; leaves 50 mm. long, elliptical-lanceolate, rather obtuse and prominently serrulate, mostly gradually narrowed to small winged petioles: otherwise about like *E.*

adenocaulon, from which this species appears barely separable by the more elliptical form and sharper serration of its leaves, and its more cinereous pubescence. — Monogr. 260. — New Mexico (*Fendler*, 1847, no. 217, in part; and *Bigelow*, on Whipple's Exped. 1853–4). — Plate 20.

E. AMERICANUM, Hausskn., Oesterr. Bot. Zeitschr. xxix. (1879), 118, and Monogr. 260, founded on specimens collected in the Saskatchewan region (*Bourgeau*, Aug. 1857), would appear to differ from *adenocaulon* only in its more sparing pubescence and smaller acute leaves, and I cannot separate it. According to Haussknecht, small plants of *Americanum* occur in the herbarium of the Museum at Paris, which are labeled "*E. tenellum*, Raf. Mts. Catskill, Et. Un. leg. Rafinesque," — but which are said not to agree with Rafinesque's description of *E. tenellum* (*E. palustre*). Such specimens seem to come very near what I regard as a very dwarf erect-leaved form of *adenocaulon*, collected in the White Mountains of New Hampshire (*Miss Prince*), the Catskills of N. Y. (*Peck*, 1880), on the Pic River (*Loring*, in Hb. Gray.), on Prince Edward Island (*Macoun*), and in the Rocky Mountains (*Bourgeau*, 1858, in hb. Gray., etc.), — which may be the *E. ciliatum* of Rafinesque in Journ. Bot. i. (1808), 229. These have crisp-pubescent peduncles, etc. As yet, however, there is too much uncertainty about the matter to warrant the application of the name *ciliatum* to either plant, unless for this dwarf form (Plate 22) either as a variety under *adenocaulon* or as a valid species immediately preceding it.

19. E. ADENOCAULON, Hausskn. — Habit of the preceding, the inflorescence, capsules, etc. very glandular pubescent and with few if any incurved hairs; leaves 50 or exceptionally 70 mm. long, frequently erect, elliptical to mostly ovate-lanceolate, obtuse, only slightly serrulate or denticulate, abruptly rounded to short winged petioles, rather pale green and glossy, glabrous except the uppermost, which are gradually reduced and seldom as rugose as in *coloratum;* flowers (mostly nodding at first) and capsules as in *coloratum;* seeds obovoid, .3 x 1.1 mm., abruptly short beaked; coma white. — Oesterr. Bot. Zeitschr. xxix. (1879), 119; Monogr. 261. — *E. coloratum*, in part, of most writers on the flora of the eastern and middle States; *E. tetragonum* of most writers on western botany, but not of Linnæus. — New Brunswick to Oregon, south to Pennsylvania, Utah and California: the Pacific Coast forms

passing into the next variety. — Specimens examined from New Brunswick and various parts of Canada and British America, Maine, New Hampshire, Massachusetts, New York, Pennsylvania, Michigan, Wisconsin, Minnesota, Montana, Colorado, Utah, Oregon, and California. — Plate 21.

Var. OCCIDENTALE. — Remotely leafy, especially the mostly strict very glandular branches; leaves more triangular-lanceolate, 50 mm. long on the main stem, erect, prominently denticulate, very short-stalked, those of the inflorescence small and acute at both ends. — Vancouver Island and British Columbia to central California, and Nevada? (*Shockley*, 509, in Hb. Gray.). — So far as can be judged from fragments of the inflorescence kindly sent me by Dr. Urban, the plants raised in the Berlin Garden from Montana seed (*Krausse*, 1882), and referred to *E. Chilense* by Haussknecht (Monogr. p. 273), may belong here; for although the lower leaves are described as different, the upper leaves are acute at base and evidently stalked. — Plate 23.

Plants from Utah, Arizona, etc. (*Palmer*, 1877, Beaver City, No. 156), Siskiyou county, California (*Pringle*, 1881, no. 110), Boulder, Col. (*Henry*, 1874), etc., have the coma dingy, and the foliage and even the lower part of the stem very glandular-puberulent, and in aspect they approach *Novo-Mexicanum*. They appear to be comparable with the most glandular form of *paniculatum*, already referred to.

This variety, which appears to be best developed in the upper Pacific region, sometimes comes too near *E. Franciscanum*, but differs in its usually smaller flowers less corymbosely clustered and more acute at base, and in its shorter glandular pubescence. It passes into the type by numerous specimens from California and the adjacent and northern region, some of which, however, are more cinereous than the eastern form of the species.*

* E. EXALTATUM, Drew, Bull. Torrey Bot. Club, xvi. (1889), 151, which Professor Greene informs me is the common tall plant of the northwest coast, would appear to be this variety, were it not for the fact that

Var. ? PERPLEXANS. — Slenderer, sub-simple or with few ascending remotely leafy branches, less glandular, the inflorescence sometimes canescent with incurved hairs; leaves scarcely 50 mm. long, divergent, lanceolate, rather obtuse and sparingly undulate-serrulate, thin and light green, the upper acutely tapering to slender sometimes elongated petioles. — Yellowstone Park to Oregon, Colorado, New Mexico, and California, apparently more abundant in the eastern part of the range. — Specimens examined from the Yellowstone, Oregon (*Hall*, 176 in part), Colorado (*Wolf*, 1873, 154), New Mexico (*Wright*, 1065, in part; *Bigelow*, 356), Arizona (*Palmer*, 1869), Nevada (Truckee Valley, *Watson*, 1867, 395 in part), and California (*Rothrock*, 1875, 217; *G. R. Vasey*, 1880). — Plate 25.

In aspect somewhat resembling *E. Californicum*, to which, perhaps, it is to be joined; but with the incurved pubescence of *E. Fendleri* and other relatives of *adenocaulon* on the flower-buds, etc. (which in some specimens are very cinereous), and more closely connected by intermediate forms with *adenocaulon* than with any other species.

20. E. CALIFORNICUM, Hausskn. — Tall, rather slender, somewhat branched, glabrous below, the inflorescence and buds white with long and rather coarse ascending hairs; leaves often 75 to 100 mm. long, lanceolate, subacute, rather remotely serrulate, rounded or acutely tapering to short petioles, soon glabrous; flowers comparatively few; fruiting peduncles slender, sometimes nearly equalling the leaves; capsules at length nearly glabrous; seeds almost beakless, .4 x .9 mm.; coma white. — Monogr. 260. — California: (Near the Russian settlement, *Wrangell*, 1833, *fide*

---

authentic Californian specimens, for the privilege of examining which I am indebted to Professor Greene and Dr. Britton, possess larger flowers with broad prominently 4-lobed stigmas. The specimen from Mr. Drew in the Columbia College Herbarium has innovations in form of open turions with decidedly fleshy scales, in this respect approaching *E. boreale*. It is quite unlike any of the species characterized by a 4-lobed stigma, and may, perhaps, prove to be a hybrid. — Plate 24.

Haussknecht; San Diego county, *Palmer*, 1875, 94 in part and 142; Santa Cruz Island, *Greene*, 1886). — Apparently this species, but with more appressed pubescence, in the Santa Rita Mountains of Arizona (*Pringle*, July 8, 1881.). — Plate 26.

Somewhat intermediate between what I have placed under *adenocaulon* as var. (?) *perplexans*, and the next species.

21. E. Parishii, Trelease.—Tall, at length stout and rather intricately branched even from the base, glabrous below, the inflorescence and capsules very sparingly, the young buds densely white tomentose; leaves 25 to 75 mm. long, lanceolate, very obtuse or the reduced uppermost leaves acutish, somewhat unequally serrulate or denticulate, gradually or abruptly narrowed to slender more or less elongated winged petioles, rather thin and glabrous; flowers at length numerous, suberect, rosy; fruiting peduncles about 15 mm. long; seeds short beaked, .4 x 1 to 1.25 mm.; coma white.— Zoe, i. (1890), 210. — San Bernardino county, California (*Parish*, Nov. 1889, nos. 2094 and 2095, the former apparently summer seedlings or offsets from the latter); and near Todos Santos, Lower California (*Brandegee*, Jan. 22, 1890), — unless this, with more closely crisp flower buds, should prove to be *E. Mexicanum*. — Plate 27.

‡‡ Habit and general characters of the preceding group, but innovations in the form of very short rhizomes ending in open fleshy-leaved turions below ground or developing into rosettes or tufts of thin leaves when they emerge: leaves not revolute.

22. E. boreale, Haùsskn.— Becoming large and considerably branched, glabrate below, very crisp-pubescent above even as to the young leaves and flower buds; leaves 50 to 75 mm. long, ovate to lanceolate, gradually very acute, coarsely denticulate to almost serrate, the upper rather gradually narrowed to evident petioles, thin; flowers finally abundant, erect, rosy, 5 mm. long; capsules at length glabrate, their crisp-pubescent peduncles scarcely 5 mm.

long; seeds and coma about as in the last.— Monogr. 279.— Grown at the Berlin Garden in 1883 from seed collected in Alaska by Krausse; Alaska, *Fisher*, 1880, in hb. Engelm., and probably *Meehan*, 1883, in hb. Canby.

I am indebted to Dr. Urban for a specimen gathered in the Berlin Garden by himself in 1883, and for another gathered in 1884 by Mr. Hennings, from which the above description is drawn. Haussknecht's original description would make the species more closely related to *E. Bongardi* than to *Californicum* or *adenocaulon*, — which I should place these specimens near. Except in pubescence they approach an Idaho specimen of what I take to be *adenocaulon* in the Hb. U. S. Dept. Agr. (*Hayden's Exp.* 1872), which, however, is densely short glandular throughout. I have not been able to consult a later note by Professor Haussknecht on this species, which was published in 1886 (Mittheil. Geogr. Ges. f. Thüringen, iv. — *fide* Just's Jahresbericht, xiii. 2, p. 284.)

+++ Producing globose or ovoid sessile or subsessile subterranean winter bulblets (turions) with fleshy scales: seeds papillate and more or less beaked. — Mostly simple or subsimple plants with the leaves usually opposite and suberect, not revolute. (Exceptions as to innovations occur in *E. Drummondii* and *E. leptocarpum*, var. *Macounii*, and the latter species is much branched and therefore with leaves chiefly alternate. The seeds of *E. Halleanum* are often nearly or quite smooth.)

++ Leaves mostly broad and ample or of medium size and with evident lateral veins (except in two varieties), sessile or subsessile except in forms of *delicatum* and *saximontanum:* stems with more or less prominent lines decurrent from some of the nodes except in some of the smaller forms. — Subsimple, with nearly erect leaves except in the first.

= Larger plants, a foot or two high, except in a variety each of *delicatum* and *ursinum* and in some forms intermediate between *Drummondii* and *saximontanum*.

23. E. DELICATUM, n. sp. — Slender stemmed, glabrous except for the crisp-hairy lines above and slightly crisp-hairy or glandular inflorescence; leaves as much as 75 mm. long, mostly very divergent, chiefly ovate-lanceolate and obtuse, undulately low-denticulate, rounded to the very short narrow base or cuneate and somewhat petioled, thin

and pale; flowers few, nodding; petals 5 to 8 mm. long, violet; capsules 40 to 60 mm., their slender peduncles about half as long; seeds finely papillate, .3 x 1 mm.; coma dingy.—Union county, Oregon (*Cusick*, 1880, No. 911, as to the larger plant, and 1882, no. 550). Specimens from the upper Flat Head River (*Canby*, 1883, No. 132), with more pubescent stems, acuter leaves, and shorter peduncles, apparently also belong here.—Plate 28.

In delicacy of leaves, this species approaches *alpinum* and especially *Californicum*, from which it differs in pubescence, innovations, etc.

Var. TENUE. — A span or so high, with narrow more erect leaves and few pale flowers. —With the type, under the number 911. The unusually large turions appear to form fleshy but more or less green rosettes when exposed to the light, in this respect approaching the preceding group. A specimen with small turions from Washington (*Brandegee*, 1882, no. 284), may go here. I cannot separate from this variety, specimens from Gray's Peak, Col. (*Patterson*, Aug. 7, 1875), but these are out of the usual range of this species, and in that of *E. saximontanum*. — Plate 28.

24. E. GLANDULOSUM, Lehm. —Tall and rather thick (but soft) stemmed, the largest specimens branched, commonly somewhat loosely crisp-pubescent above or with very flexuous glandular hairs; leaves typically crowded near the summit, frequently exceeding the inflorescence, 80 to 120 mm. long, broadly ovate or ovate-lanceolate, the upper acute or sub-acuminate, prominently serrulate, mostly abruptly rounded to the base, drying dark; flowers erect, near the end of the stem; petals 5 to 7 mm. long, more or less purple; capsules about 60 mm., short-stalked, occasionally quite pubescent; seeds coarsely hyaline-papillate or with the papillæ often entirely collapsed, very blunt above, .5 x usually 1.5 to 1.8 mm.; coma dingy. — Pugillus, ii. (1830), 14; Haussknecht, Monogr. 273.—Alaska and across the islands of the northwest to Asia. Forms too near this also in British Columbia. — Plate 29.

Young specimens doubtfully referred here occur in the Gray herbarium from Labrador (*Allen*, 1882, no. 11, as *E. coloratum*), but I am unable to find specimens authenticating the general distribution ascribed to the species by Professor Haussknecht, on whose authority it was admitted to the sixth edition of Gray's Manual.

The separated decurrent lines of some Arctic specimens are more or less wing-like, then bearing prominences similar to the marginal teeth of the leaves, from which the specific name is said to be derived.

25. E. BREVISTYLUM, Barbey. — Slenderer and less pubescent; leaves scarcely 40 mm. long, ovate or ellipiticals more loosely and uniformly distributed along the stem, less toothed, drying pale, the uppermost reduced and surpassed by the nearly glabrous capsules; seeds slightly smaller, tapering above, the papillæ similar; coma less dingy. — Brewer & Watson, Bot. Calif. i. (1876), 220; Barbey & Cuisin, pl. 13. — Springs, etc., Washington to California. — Apparently too close to the last by specimens from British Columbia and Colorado (*Vasey*, 1868, No. 184; *Engelmann*, 1881), which are rather in the region of *Drummondii*. — Plate 30.

I am unable to find the original specimen in the Gray herbarium, but the figure of Barbey & Cuisin seems to represent the form here described, which is of very different appearance from the large Arctic form of *glandulosum* to which Haussknecht doubtfully joins it.

E. affine, β. *fastigiatum*, Nuttall in Torr. & Gr. Fl. i. 489, which might be thought to refer to this form, proves (at least in Hb. Torrey.) to be *E. glaberrimum*, var. *latifolium*, with leaves rather more dentate than usual.

26. E. URSINUM, S. B. Parish, in herb. — A span to a foot high, slender, both leaves and stem below pilose with rather remote and spreading long white hairs, the inflorescence minutely glandular-pubescent; leaves less than 30 mm. long, rather uniformly and in larger plants remotely

distributed, ovate or broadly lanceolate, the upper subacute and serrate, the lower blunter and finely denticulate or nearly entire, very abruptly rounded to the sessile base; flowers few, erect or somewhat nodding; petals white or lavender, about 5 mm. long; capsules ascending, 30 mm. long, on very slender peduncles of more than half their length, soon glabrous; seeds often very rough, short-beaked, .5 x 1.5 mm.; coma rather scant, white. — San Bernardino county, California (*Parish*, 1882, no. 1619) to Washington (*Suksdorf*, 1880, 372). A specimen from the Snake River (*Hayden*, June 15, 1860) also appears to go here. — Plate 31.

Var. SUBFALCATUM. — Lower but often branched below, almost without decurrent lines, densely tomentose or pilose to the glandular shorter inflorescence; leaves narrower, sometimes falcate, entire or remotely and inconspicuously denticulate, mostly obtuse, more cuneate at base, more tomentose, and with inconspicuous lateral veins; capsules at first very short stalked. — California (*Gray*, 1872; *Mrs. Austin*, 1877; *Pringle*, 1882) to Oregon (*Howell*, 1887, no. 694). — This bears the same relation to *ursinum* that the var. *tenue* does to *delicatum*. — Plate 32.

27. E. HALLEANUM, Hausskn. — Tall and slender, glandular-puberulent throughout or soon glabrous below; leaves remote, mostly ascending, 20 to 30 mm. long, ovate- or oblong-lanceolate, the lower obtuse, decidedly undulate-serrulate, abruptly sessile or some of them clasping-decurrent by the broad base; flowers and capsules ultimately rather remote in the upper axils; petals 5 to 6 mm. long, pale to mostly rather deep violet; capsules about 50 mm., on slender peduncles of nearly equal length and exceeding the subtending leaves; seeds sometimes smooth, usually very finely papillate, .4 to .5 x 1.5 to 1.7 mm., fusiform, blunt at base, with gradually narrowed pale apex and hyaline beak; coma scarcely dingy. — Monogr. 261. — Vancouver Island (*Macoun*, 1887, nos. 9 and 9*b*), Washington (*Suks-*

dorf, 1881, no. 15), and Oregon (*Hall*, 1871, nos. 176 and 178 in part).—What may be a verticillate-leaved form of this, collected in Oregon by Nuttall, occurs as *E. glandulosum* in the Gray and Torrey herbaria.—Plate 33.

Well marked by its decurrent leaves and the peculiar apex of its large seeds. Suksdorf's specimens bear well-developed turions, removing the species from the rosuliferous group in which Professor Haussknecht placed it in the absence of innovations.

28. E. Drummondii, Hausskn.—A span to mostly a foot high, glandular above, the decurrent lines subglabrate; leaves 25 to 40 mm. long, typically remote and erect, lanceolate to almost linear-lanceolate, rather acute, the upper, especially, denticulate, mostly rounded to the subsessile base; flowers erect; petals 3 to 4 mm. long, usually pale; capsules 30 to 50 mm. long, slender-stalked; seeds .3 to .45 x 1.2 to 1.4 mm.—Monogr. 271.—Mountains, from Montana to Colorado and Nevada.—Young specimens with leaves in whorls of 3, from British Columbia (*Macoun*, 1875, no. 1935 in hb. Macoun.), may belong here.—Plate 34.

This, the more typical form of *E. Drummondii*, is very closely related to *E. brevistylum*, but differs in its narrower more toothed leaves not so pale when dry, its more finely and sharply papillate seeds, and in the fact that its turions often lengthen at base into short sobols. With more glandular pubescence above and still more deeply toothed leaves, it approaches *E. Halleanum*, from which it differs in its smaller seeds and leaves never decurrent-clasping. Smaller plants, with broader more divergent leaves, greatly obscure the limits between this and the next species.

= = Smaller plants scarcely over a span high. (Varieties of *delicatum* and *ursinum* might be sought here.)

29. E. saximontanum, Hausskn.—Somewhat crisp-hairy at least along the elevated lines, and glandular above; leaves about 20 mm. long, mostly crowded and ascending

or suberect, oblong to elliptical, the upper rather acute, very minutely denticulate or subentire, cuneately narrowed to the sessile base, — or the lowest 30 mm. long, more lanceolate, and with somewhat elongated winged base; flowers few, pale to deep violet; capsules short stalked; seeds slightly larger and often less papillate: otherwise like the preceding, except for the sessile turions. — Oesterr. Bot. Zeitschr. xxix. (1879), 119; Monogr. 270. — Mountains, Colorado to Nevada. — Plate 35.

The broader-leaved form figured (Arizona, *Knowlton*, 1889, no. 151, etc.) is barely distinguishable from broader-leaved forms referred to the preceding species; but the specimens are commonly without innovations, and hence may belong elsewhere, though at present I am unable to place them otherwise.

++ ++ Leaves rather small, with less conspicuous lateral veins, evidently petioled: stems terete but sometimes pubescent in lines. — Much-branched small plants, with the rather spreading leaves therefore mainly alternate.

30. E. LEPTOCARPUM, Hausskn. — A span or less high, glabrous except for some incurved pubescence on the stem; leaves less than 20 mm. long, broadly lanceolate, sparingly low-toothed, tapering from near the middle to the obtuse or subacute apex and winged petiole; flowers abundant for the size of the plant; calyx-tube narrow; petals about 3 mm. long, rosy; capsules 20 mm., on very slender peduncles of nearly equal length; seeds nearly ellipsoidal, shortly hyaline-beaked, .25 x .75 mm.; coma at length cinnamon-colored. — Monogr. 258, pl. 14, f. 67. — Oregon (*Hall*, no. 188). — Suggestive of some small rosuliferous species of the *coloratum* group, and so placed by Haussknecht, in the absence of innovations on the only specimens known. — Plate 36.

Var.? MACOUNII. — Less branched, crisp-pubescent in lines, the same pubescence more or less abundant also on the flowers and capsules; leaves more ovate; seeds 1 mm.

long; coma paler. — Lake Athabasca (*Macoun*, 1875, no. 692), to Washington (*Suksdorf*, 1885, no. 551).—Plate 37.

Innovations occur in the form of small slightly elongated turions which may lengthen into closely scaly rhizomes and develop into leafy shoots in the first season.

Simple, taller, thicker-leaved plants of the general habit of this variety were collected at Glacier Bay, Alaska, by G. F. Wright in 1886 (Hb. Gray.), but I hesitate to place them definitely. They also suggest in some respects forms of *E. Hornemanni*. Some specimens resembling this variety also occur in the herbarium of the Department of Agriculture among Watson's plants from Utah and Nevada.

‡ ‡ ‡ Producing subterranean scaly branches (sobols), which ultimately turn upward and usually develop at once into leafy shoots.

†† Glabrous (or occasionally very slightly glandular above), and glaucous: stems terete, slender, rather tall except in the variety, usually somewhat cespitose: leaves mostly simple and opposite, subsessile, with faint lateral veins: flowers erect or suberect: seeds obovoid, scarcely beaked, coarsely papillate.

31. E. GLABERRIMUM, Barbey. — About a foot high, simple or nearly so; leaves erect or ascending, often remote, as much as 50 mm. long, all but the lowest lanceolate, rather obtuse, entire to slightly repand, mostly cuneately narrowed to the sometimes subpetioled base; petals purple to nearly white, 4 to 8 mm. long; capsules 75 mm., linear-falcate, usually conspicuously stalked; seeds .3 to .5 x 1 mm., very rough with blunt papillæ, abruptly rounded to the short insertion of the barely dingy coma. — Brewer & Watson, Bot. Calif. i. (1876), 220; Barbey & Cuisin, pl. 5. — *E. pruinosum*, Hausskn. Monogr. 252, pl. 15, f. 70. — Washington (*Suksdorf*, 1878 and 1885) and Oregon (*Howell*, 1887, no. 696), to various parts of California; a broader-leaved form also in California, and Nevada (*Anderson*, 1864, no. 7). — Plate 38.

Var. LATIFOLIUM, Barbey. — Rather firmer stemmed and more branched, sometimes dwarf; leaves more diver-

gent, scarcely 25 mm. long, broadly ovate to ovate-lanceolate, mostly subcordately contracted to the very short base. — Bot. Calif. i. (1876), 220. — *E. glaberrimum*, Hausskn. Monogr. 252. — *E. affine*, β. *fastigiatum*, Nutt. in Torr. & Gr. Fl. i. (1840), 489, as to the specimen in the Torrey herbarium. — Oregon to California and the Wahsatch Mountains of Utah, — apparently most developed about the outer range of the species. — Small specimens approach *E. Hornemanni* in habit. — A restoration of Nuttall's name would cause the variety to be known as *E. glaberrimum*, var. *fastigiatum* (Nutt.). — Plate 39.

++ ++ Puberulent, at least in lines: seeds more fusiform, usually somewhat beaked above.

= Seeds papillate.

E. Oreganum, Greene. — A couple of feet high, rather stout, simple or with ascending branches, glabrate and glaucous below, glandular-puberulent above; leaves ascending, as much as 75 mm. long, lanceolate, obtuse, closely denticulate, cuneately subsessile or abruptly rounded to short winged petioles, veiny; flowers rather numerous, erect in the axils of the reduced upper leaves; calyx-tube 3 mm. long, rather narrowly funnel-form; petals violet, 8 to 12 mm. long; style about equalling the corolla, pubescent near the apex and on the outside of the four widely divergent stigmatic lobes; capsules nearly erect, 40 mm. long, usually subsessile; seeds oblong-fusiform, obliquely pointed at base, very shortly pellucid-beaked, .25 x .75 to 1 mm.; coma white. — Pittonia, i. (1889), 225. — *E. glaucum*, Howell, List for 1887, p. 3, *not* Phil. & Hausskn. — Grant's Pass, Oregon (*Howell*, July 1887, distributed as nos. 699 and 1139). — Specimens distributed as no. 695 by Howell in the same year appear to be a slenderer form of the same, and in habit and innovations closely approach *E. glaberrimum*. Specimens of the typical numbers in Hb. Dept. Agr. have short sobols somewhat rosuliferous at end, but most of those that I have seen do not show the innovations. — Plate 40.

I cannot resist the impression that *E. Oreganum* is a hybrid of *glaberrimum*, the vegetative characters suggesting *adenocaulon* as a possible other parent.

32. E. Hornemanni, Reichenb. — Mostly a span or two high, ascending, unbranched, somewhat crisp-hairy in the inflorescence and along the decurrent lines, or slightly glandular at top, otherwise glabrate; leaves about 25 mm. long, subascending, elliptical-ovate, mostly very obtuse, nearly netire to remotely serrulate, the lower cuneately narrowed,

the upper usually abruptly rounded to the short petioles; flowers rather few, nearly erect; petals 5 to 8 mm. long, lilac to deep violet; capsules as much as 50 mm., slender, erect, on slender peduncles about equalling the gradually reduced subtending leaves; seeds rather abruptly short-appendaged, from nearly smooth to very rough, .3 to .4 x 1 mm.; coma somewhat dingy. — Icon. Crit. ii. (1824), 73; Haussknecht, Monogr. 174. — Mountains, British Columbia to California, Colorado, and Utah; also in Europe.— Specimens examined from various parts of British Columbia (*Macoun*), Washington (*Howell; Brandegee* 1882, no. 285), Oregon (*Hall*, 1871, no. 0), California (*Newberry; Brewer* 1860–62, no. 1417), Idaho (*Watson*, 1880, no. 146), the Yellowstone region (*Hayden; Tweedy* 1885, no. 519), Colorado (*Parry*, 1861, no. 121; *Vasey*, 1868, no. 187,—188 an albino of the same; *Engelmann; Jones* 1878, no. 377; *Nuttall; Hall & Harbour* 1862, no. 167), and Utah (*Hooker & Gray*, 1877; *Jones* 1879, no. 1099 in part and 1103). — Plate 41.

The following variations from the western form occur: —

a.—Slender and low, with smaller elliptical spreading leaves, few suberect small flowers, short capsules, and small seeds. — Dells of the Wisconsin River (*Lapham*) to the Saguenay River (*Pringle*, 1879). —Apparently annual, in aspect very near the dwarf form mentioned under *adenocaulon*, and perhaps not rightly referred here. — Plate 42.

b. — From slender and low to quite stout, as much as a foot high, and few-branched, with ovate very divergent mostly long- and slender-stalked leaves, usually very nodding large flowers, and rather large very broad seeds.— White Mountains of New Hampshire to Labrador (*Allen*, 1882, no. 50) and westward, passing into the usual western form. — Plate 42.

In this species the sobols sometimes pass insensibly into leafy shoots arising above ground, showing the impossibility of maintaining a sharp distinction between the soboliferous and stoloniferous groups.

Specimens of the aspect of this species, but as much as a foot and a half high, and some of them branched above, with the flower buds 8 to 10 mm. and the violet petals 12 mm. long, and with deeply 4-lobed stigma, were collected on Mt. Stewart, Washington, by Mr. Brandegee (Aug. 1883, no. 778 in Hb. Gray., Hb. Canby., etc.). They appear to be hybrids of this species, but I do not venture to suggest the other parent.

= = Seeds smooth or merely areolate. — A single species of the habit of *Hornemanni*, but passing into the following group by its smooth seeds.

33. E. Bongardi, Hausskn. — A foot or less high, erect, simple, with crisp-hairy lines, the apex at first nodding; leaves 25 to 50 mm. long, rather ascending, crowded above, very broadly lanceolate, the upper acute, sharply but remotely denticulate, usually crisp-ciliate, gradually narrowed to the conspicuous cuneately winged base, veiny, drying brown; inflorescence sparingly glandular; flowers rather few, somewhat nodding; petals about 8 mm. long, pale or rosy; capsules rather slender, 40 mm. long, on slender peduncles much shorter than the leaves; seeds nearly beakless, .4 x 1.3 mm.; coma very dingy. — Oesterr. Bot. Zeitschr. xxix. (1879), 89; Monogr. 278. — Alaska and the adjacent islands. — Plate 43.

+-+-+-+- Often more or less cespitose by leafy stolons, otherwise simple or nearly so: sometimes apparently annual.

++ Seeds smooth or at most undulate-areolate except in forms referred to *Oregonense*.

= Habit of *E. Hornemanni*, with rather ample leaves.

34. E. Behringianum, Hausskn. — A span to nearly a foot high, sometimes with ascending branches from near the base, more or less nodding at apex, glabrous except for the shortly crisp-pubescent lines; leaves about 40 mm. long, mostly broadly ovate, subentire or the acutish upper ones slightly

denticulate and somewhat crisp-ciliate, all but the lowest abruptly contracted and sessile, subglaucous, less veiny, more rigid, and drying greener than in the last; flowers erect, rosy; seeds short-beaked. — Monogr. 277. — Coast and insular region from Alaska to N. E. Asia, according to Haussknecht, from whose description the characters are taken, as I have seen no specimens which I can clearly separate from the preceding species.

35. E. ALPINUM, L. — Size and habit of *E. Hornemanni*, but the inflorescence and decurrent lines more nearly glabrous; leaves uniformly distributed, thin and delicate, pale green, 40 mm. long, subelliptical, rather obtuse, subentire to somewhat sharply serrulate, gradually narrowed to slender petioles; flowers few, suberect in the upper axils; petals about 3 mm. long, white or rosy-tipped; capsules very slender, erect or ascending, about 50 mm. long, their peduncles rather slender and about equalling the subtending leaves or stouter and as long as the capsules; seeds smooth, gradually attenuated at apex, with very evident beak. — Sp. i. (1753), 348, in part. — *E. lactiflorum*, Haussknecht, Oesterr. Bot. Zeitschr. xxix. (1879), 89; Monogr. 158. — Canada to Vancouver Island, extending southward in the mountains to New Hampshire, Utah, and California(?); also in Europe. — Specimens examined from various parts of British America (*Macoun*), the White Mountains, Colorado (*Coulter*, 1873), Utah (*Watson*, 1869, no. 394 in part; *Porter*, 1873; *Jones*, 1879, no. 1099 in part), Washington (*Suksdorf*, 1881, no. 10), Oregon (*Howell*, 1880, no. 325; *Henderson*, 1890, no. 344), and California? (*Mrs. Austin; Palmer* 1888, nos. 218 and 219). — Occurring with *E. Hornemanni*, which it closely resembles except for its more delicate, pale leaves, smaller white flowers, and smooth seeds attenuated to the beak. — Plate 44.*

*The original *alpinum* of Linnæus included with this *E. Hornemanni* and *E. anagallidifolium*. The first-named was separated by Reichenbach in 1824; the second, by Lamarck in 1786. Although the name *alpinum* has been applied indiscriminately to all three by many writers, I do not

= = Habit of *E. anagallidifolium*, with narrow subentire leaves (these more toothed in *pseudo-scaposum*).

36. E. OREGONENSE, Hausskn. — A span high, with few sterile shoots at base, erect even as to the apex, glabrous except for very sparing glandular hairs in the inflorescence; leaves 15 to 20 mm. long, crowded below, remote and very small above, suberect, narrowly oblong-ovate or the uppermost linear, very obtuse, remotely low-denticulate, somewhat cuneately narrowed at base but sessile, rather delicate and with slightly evident lateral veins; flowers few, strictly erect; petals deep violet, about 8 mm. long; capsules about 50 mm., slender, strict, much surpassing the summit of the stem, their very slender peduncles of nearly equal length and far exceeding the subtending leaves; seeds (immature) smooth, blunt, apparently beakless. — Monogr. 276, pl. 14, f. 66. — Bogs, Oregon (*Hall*, 1871, no. 179) to British Columbia (Swamp River, *Macoun*, 1875, no. 1921 in part). — Plate 25.

Young Californian plants referred here with considerable doubt, have small but more ovate leaves drying brownish (*Bolander*, nos. 1786 and 4965; *Lemmon*, 1875 — the leaves in whorls of 3 in one specimen). Here also, perhaps, would be referred plants collected in Tulare county, California (*Palmer*, 1888, 218 in part, and 220). In the latter, especially, the internodes lengthen and the leaves are very narrow above, as in the type, but the lower leaves are short and ovate. Except for their larger size and more erect habit, however, these round-leaved plants are not unlike some of the more erect European forms of *anagallidifolium*, — *e. g.* a specimen from the Clova Mts., Scotland, collected by Greville in 1839.

Var. ? GRACILLIMUM. — A span to nearly a foot high, often quite cespitose, very slender, quickly erect and hardly

---

think it best to follow Professor Haussknecht in adopting a new name for what is left of the original *alpinum*, but prefer still to employ for it the name given it by Linnæus. Nor should I follow H. and J. Groves in allowing the latest name, *lactiflorum*, to stand, while displacing *anagallidifolium*.

bent at top, glabrous except the very minutely and sparingly glandular inflorescence; leaves mostly uniformly distributed, gradually reduced above, suberect, shorter than the internodes, narrower, entire, keeled on the mid-rib, without evident lateral veins, the lowest or those on sterile shoots often cuneately subpetioled; flowers few, nearly erect; petals white or pale, 6 mm. long; seeds .3 x 1 mm., broadly and bluntly but evidently papillate, the beak scarcely hyaline. — Bogs, Strawberry Valley, California (*Pringle*, 1881, no. 80) to Washington (*Suksdorf*, 1878, 1885, and 1886 no. 860, — the former with broader, more veiny, and more crowded leaves, and occasional crisp pubescence on the stem). — Plate 46.

37. E. ANAGALLIDIFOLIUM, Lam. — About a span high, at length rather densely cespitose, otherwise unbranched, the very slender stems commonly sigmoidally bent, and strongly nodding at apex, somewhat crisp-hairy at least in lines and occasionally very slightly glandular in the inflorescence; leaves 10 to 20 mm. long, ascending, rather uniformly distributed, all but the lowermost very narrowly ovate or oblong, rather obtuse, entire or remotely very low denticulate, cuneately narrowed, the lowest mostly wing-petioled, rather firm and inconspicuously veined, drying brown; flowers few, crowded at apex, somewhat nodding; petals lilac to violet, about 5 mm. long; capsules 25 mm., slender, surpassing the end of the stem, their rather slender peduncles shorter than the leaves or, when only one or two are present, equalling the capsules; seeds somewhat obovoid-fusiform, short-beaked, .3 x 1 mm.; coma somewhat dingy. — Dict. ii. (1786), 376; Haussknecht, Monogr. 152. — From Labrador across Arctic America, south to the mountains of California (*Greene*, etc.), Colorado, and Nevada (*Watson*, 1868, no. 394 in part). Also in the Old World. — Plate 47.

Perhaps the lowest but slightly rough-seeded plants referred to the last belong here.

E. PSEUDO-SCAPOSUM, Hausskn. — About a span high from a filiform rooting rhizome, slender, erect from an ascending base, pubescent along the prominent decurrent lines; leaves about 12 mm. long, crowded, round-ovate, obtuse, subentire to sparingly angular-toothed, subsessile or on sterile shoots abruptly narrowed to short petioles, firm; flowers one or two, when solitary apparently terminal; capsules erect, 40 mm. long, on peduncles of equal length; seeds obovoid-oblong, shortly beaked, .3 x 1 mm.— Oesterr, Bot. Zeitschr. xxix. (1879), 89; Monogr. 278, pl. 13, f. 65. — Aleutian Islands (*Mertens*), *fide* Haussknecht, — hence likely to occur in Alaska, but unknown to me.

++ ++ Seeds often coarsely papillate, nearly one-half larger than in the preceding group.

38. E. CLAVATUM, n. sp. — A span high, mostly densely cespitose, the slender stems ascending, glabrate to sparingly glandular throughout; leaves 15 to 20 mm. long, divergent, broadly ovate, very obtuse, subentire to remotely serrulate, mostly rounded to evident petioles, firm, drying brownish; flowers rather few, suberect, petals rose-colored, about 5 mm. long; capsules 25 mm., subclavate, arcuately divergent, the lowest often not reaching the apex of the stem, their slender peduncles equalling the subtending leaves; seeds fusiform, tapering into a pale beak, nearly smooth to coarsely papillate, .4 to .6 x 1.5 to 2 mm.; coma barely dingy. — Washington and Oregon to Wyoming and Utah.— Specimens examined from Kicking Horse River, British America (*Macoun*, 1890), Mt. Adams, Washington (*Suksdorf*, 1877 and 1886), Oregon (*Cusick*, 1879, and 1880 no. 821; *Howell*, 1886, no. 595), the Cascade Mts. (*Tweedy*, 1882, no. 319), Wyoming (*Parry*, 1873, no. 110), and perhaps Utah (Uintas, *Watson*, 1869, no. 394 in part). —Plate 48.

Suggestive of a hybrid between *anagallidifolium* and *Hornemanni*, but with very much larger, abundant, and apparently good seeds.

EXPLANATION OF PLATES ILLUSTRATING THE NORTH AMERICAN SPECIES OF EPILOBIUM.

Plates 1 to 3 were drawn by Miss M. H. Hoke; the remainder, by Mrs. J. C. Duffey. Except where the contrary is stated, the figures are from herbarium specimens selected by the author and drawn under his supervision. Figures of seeds and stigmas are from drawings by the author. In all but one figure of seeds, the coma is omitted, for simplicity.

Plate 1, *E. spicatum*, Lam. — 1, Portion of plant, reduced one-half; 2, base of stem, showing the separated scales of the winter bud from which it developed, natural size; 3, longitudinal section of flower, enlarged; 4, cross section of ovary, and two ovules, — the coma removed from one of them, enlarged; 5, capsule, x 2; 6, portion of capsule, showing mode of dehiscence, enlarged; 7, seed, x 25. — Figs. 3, 4, and 6, after sketches by Sprague, in the Gray Herbarium.

Plate 2, *E. latifolium*, L. — 1, Portion of plant, reduced one-half; 2, base of stem, with scales and winter buds, natural size; 3, seed, x 25.

Plate 3, *E. hirsutum*, L. — 1, Plant, reduced one-half; 2, seed, and cross-section of same, x 25.

Plate 4, *E. luteum*, Pursh. — 1, Plant, reduced one-half; 2, leaf, natural size; 3, capsule, natural size; 4, stigma, x 12; 5, seed, x 25.

Plate 5, *E. rigidum*, Hausskn. — 1, Two plants, reduced one-half; 2, leaf, x 2; 3, young capsule, x 2; 4, stigma, x 12; 5, immature seed, x 25.

Plate 6, *E. obcordatum*, Gray. — 1, Plant, natural size; 2, stigma, x 12; 3, seed, x 25.

Plate 7, *E. suffruticosum*, Nutt. — 1, Plant, natural size; 2, capsule, x 2; 3, stigma, x 25; 4, seed, x 25.

Plate 8, *E. paniculatum*, Nutt. — 1, Plant, reduced one-

half; 2, a large flower, natural size; 3, capsule, x 2; 4, stigma, x 25; 5, seed, x 25.

Plate 9, *E. paniculatum*, Nutt., var. *jucundum*, (Gray). — 1, Plant, reduced one-half; 2, leaf, x 2; 3, capsule, x 2; 4, stigma, x 25; 5, seed, x 25.

Plate 10, *E. minutum*, Lindl. — 1, Rather large plant, reduced one-half; 2, leaf, x 2; 3, capsule, x 2; 4, stigma, x 25; 5, seed, x 25.

Plate 11, *E. strictum*, Muhl. — 1, Plant, reduced one-half; 2, leaf, x 2; 3, flowering and fruiting apex of stem, natural size; 4, stigma, x 25; 5, seed, x 25.

Plate 12, *E. lineare*, Muhl. — 1, small and little branched plant, reduced one-half; 2, three young bulblets, x 9; 3, leaf, x 2; 4, stigma, x 25; 5, seed, x 25. — The bulblets become at length narrowly ovoid, and 12 mm. or more long.

Plate 13, *E. palustre*, L. — 1, Plant of the usual Rocky Mountain form, reduced one-half; 2, leaf, x 2; 3, bulbiferous subterranean shoot, natural size; 4, stigma, x 25; 5, seed, x 25; 6, plant of the forma *Labradorica*, natural size; 7, leaf of same, x 2.

Plate 14, *E. Davuricum*, Fisch. — 1, Fruiting plant from the Rocky Mountains, natural size; 2, flowering specimen from Norway, natural size; 3, rosettes at base of stem, x 2; 4, leaf, x 2; 5, nodding apex of flowering plant, natural size; 6, stigma (from Norwegian plant), x 25; 7, seed (from Rocky Mountain plant), x 25.

Plate 15, *E. Franciscanum*, Barbey. — 1, Portion of large plant, reduced one-half; 2, stigma, x 25; 3, seed, x 25.

Plate 16, *E. Watsoni*, Barbey. — 1, Plant with small innovations, reduced one-half; 2, stigma, x 25; 3, seed, x 25.

Plate 17, *E. holosericeum*, n. sp. — 1, Portions of plant, reduced one-half; 2, capsule, natural size; 3, stigma, x 25; 4, seed, x 25.

Plate 18, *E. Fendleri*, Hausskn. — 1, Portion of plant, reduced one-half; 2, stigma, x 25; 3, seed, x 25.

Plate 19, *E. coloratum*, Muhl. — 1, Plant, reduced one-half; 2, capsule, x 2; 3, stigma, x 25; 4, seed, x 25.

Plate 20, *E. Novo-Mexicanum*, Hausskn. — 1, Plant, reduced one-half; 2, stigma, x 25; 3, seed, x 25.

Plate 21, *E. adenocaulon*, Hausskn. — 1, Medium-sized plant, reduced one-half; 2, rosuliferous base of same, natural size; 3, stigma, x 25; 4, seed, x 25.

Plate 22, *E. adenocaulon*, Hausskn. (?) — dwarf form which may possibly be the *E. ciliatum* of Rafinesque. — Three plants, natural size; seed, x 25.

Plate 23, *E. adenocaulon*, Hausskn., var. *occidentale*. — 1, Plant, reduced one-half; 2, stigma, x 25; 3, seed, x 25.

Plate 24, *E. exaltatum*, Drew. — 1, Portions of plant with rosuliferous base, reduced one-half; 2, base of another plant with fleshy-scaled autumnal shoot, reduced one-half; 3, stigma, x 25; 4, seed, x 25.

Plate 25, *E. adenocaulon*, Hausskn., var. (?) *perplexans*. — 1, Plant, reduced one-half; 2, two young autumnal rosettes, x 2; 3, seed, x 25.

Plate 26, *E. Californicum*, Hausskn. — 1, Portion of plant, reduced one-half; 2, opening flower-bud, x 2; 3, seed, x 25.

Plate 27, *E. Parishii*, Trel. — 1, Young autumnal plant with rosettes, reduced one-half; 2, a rooted innovation, natural size; 3, stigma, x 25; 4, seed, x 25.

Plate 28, *E. delicatum*, n. sp. — 1, Plant, reduced one-half; 2, young seed, x 25. — 3, Var. *tenue*, reduced one-half; 4, two turions of same, natural size; 5, stigma of same, x 25.

Plate 29, *E. glandulosum*, Lehm. — 1–2, Flowering and fruiting summits of plants, reduced one-half; 3, stigma, x 25; 4, seed, x 25.

Plate 30, *E. brevistylum*, Barbey. — 1, Plant, reduced one-half; 2, base of stem at end of season, showing old and newly-formed turions, natural size; 3, flowering and fruiting summit of plant, natural size, — one flower showing a

rather frequent form of monstrosity; 4, stigma, x 25; 5, seed, x 25.

Plate 31, *E. ursinum*, Parish. — 1, Plant, reduced one-half; 2, portion of stem and leaves, x 2; 3, base of stem with turion, x 2; 4, stigma, x 25; 5, seed, x 25.

Plate 32, *E. ursinum*, Parish, var. *subfalcatum*. — 1 to 2, Two plants, natural size; 3, portion of stem and leaves, x 2; 4, seed, x 25.

Plate 33, *E. Halleanum*, Hausskn. — 1, Plant, reduced one-half; 2, flowering apex, natural size; 3, base of stem, with turions, x 2; 4, stigma, x 25; 5, seed, x 25.

Plate 34, *E. Drummondii*, Hausskn. — 1, Upper portion of more typical slender plant, reduced one-half; 2, stalked turion, x 2; 3, leaf, x 2; 4, stigma, x 25; 5, seed, x 25; 6, smaller plant, approaching *E. saximontanum*, reduced one-half.

Plate 35, *E. saximontanum*, Hausskn. — 1, Two plants of the more typical form, natural size; 2, turion, natural size; 3, seed, x 25; 4, broader-leaved form, approaching *E. Drummondii*, natural size.

Plate 36, *E. leptocarpum*, Hausskn. — 1, Plant, natural size; 2, leaf, x 2; 3, petal, x 12; 4, stigma, x 25; 5, seed, x 25.

Plate 37, *E. leptocarpum*, Hausskn., var. (?) *Macounii*. — 1, Large plant, natural size, — the old turion at base, also, x 2; 2, small plant with young turion, natural size, — the latter, also, x 2; 3, seed, x 25.

Plate 38, *E. glaberrimum*, Barbey. — 1, Plant, redueed one-half; 2, stigma, x 25; 3, seed, x 25.

Plate 39, *E. glaberrimum*, Barbey, var. *latifolium*, Barbey. — 1, Two plants, reduced one-half; 2, stigma, x 25; 3, seed, x 25.

Plate 40, *E. Oreganum*, Greene. — 1, Portion of plant, reduced one-half; 2, stigma, x 25; 3, seed, x 25.

Plate 41, *E. Hornemanni*, Reichenb. — 1, Two plants of the more typical Rocky Mountain form, natural size; 2, innovation, x 2; 3, seed, x 25.

Plate 42, *E. Hornemanni*, Reichenb. — 1, Large form of the White Mountains, natural size; 2, stigma of same, x 25; 3, seed of same, x 25. —4, Two plants of dwarf form of the Northeast questionably referred here, natural size; 5, seed of same, x 25.

Plate 43, *E. Bongardi*, Hausskn. — 1, Two plants, natural size; 2, stigma, x 25; 3, seed, x 25.

Plate 44, *E. alpinum*, L. (*E. lactiflorum*, Hausskn). — 1, Three plants, natural size; 2, innovations, x 2; 3, stigma, x 25; 4, seed, x 25.

Plate 45, *E. Oregonense*, Hausskn. — 1, Three plants, natural size; 2, leaf, x 2; 3, stigma, x 25; 4, seed, x 25; 5, fragment of specimen doubtfully referred here, with leaves in threes, x 2.

Plate 46, *E. Oregonense*, Hausskn., var. (?) *gracillimum*. — 1, Two plants, natural size; 2, stigma, x 25; 3, seed, x 25; — 4, nodding specimen of Suksdorf, doubtfully referred here but perhaps belonging to the next, natural size.

Plate 47, *E. anagallidifolium*, Lam. — 1, Three plants, natural size; 2, unusually erect plant, natural size; 3, exceptionally toothed leaf, x 2; 4, capsule, natural size; 5 stigma, x 25; 6, seed, x 25.

Plate 48, *E. clavatum*, n. sp. — 1, Plants, natural size; 2, rougher form of seed, x 25; 3, smoother form of seed, x 25.

Since the preceding pages were in print, I have discovered that the plant which here appears as *E. Oregonense*, var. (?) *gracillimum*, has been published by Professor Haussknecht in Mittheil. Geogr. Gesellsch. zu Jena, 1888, vii. 5, —*fide* Just, Jahresb. xvi (2), 156—, as *E. Prinogleanum*, Hausskn, so that it should bear this name.

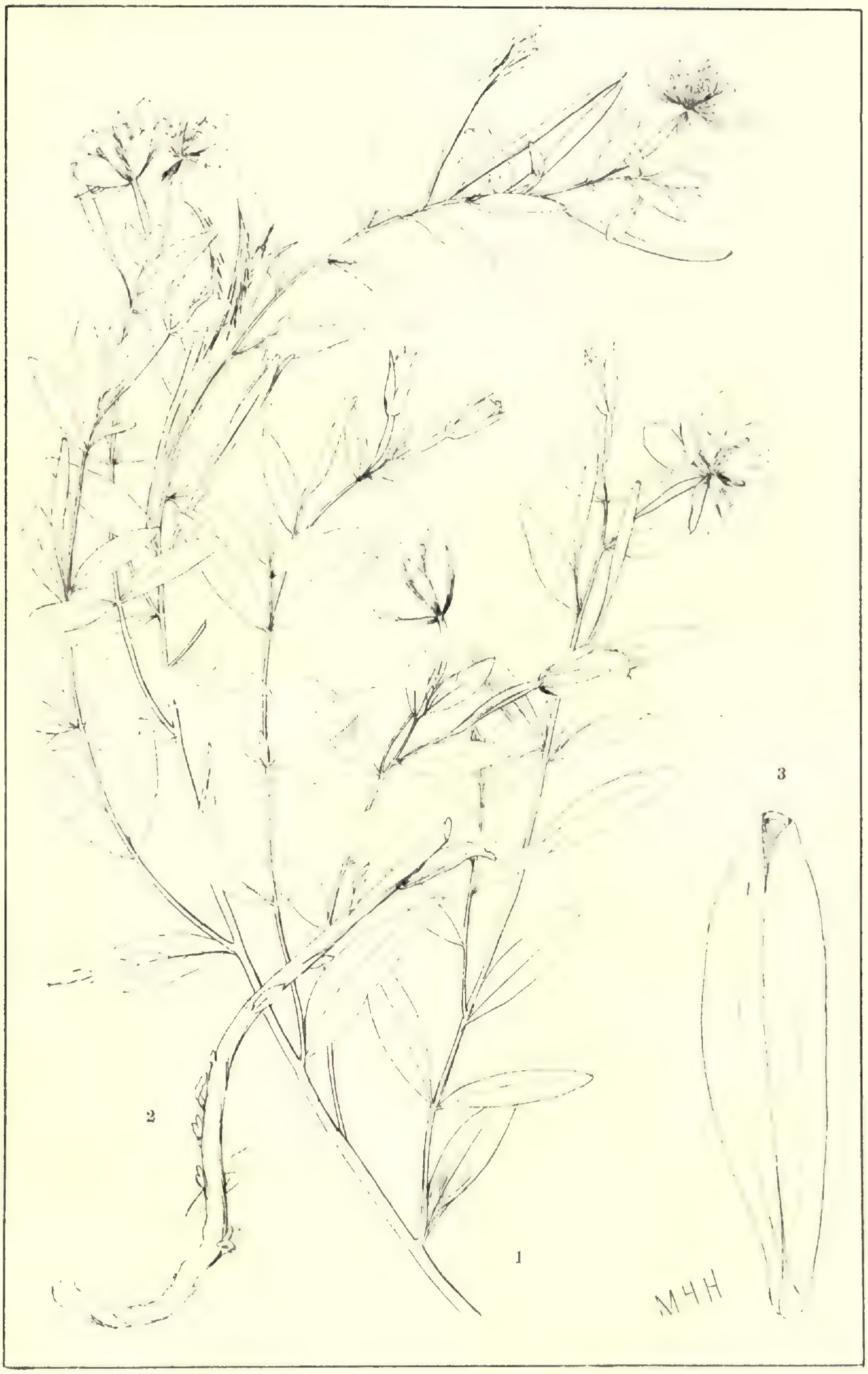
INDEX TO SPECIES OF EPILOBIUM.

Synonymes in parentheses.

adenocaulon, 91, 93, 94, 98, 105, 106.
adnatum, 92.
affine, (100, 105).
alpinum, 108.
Americanum, (94).
anagallidifolium, (89, 108, 109), 110, 111.
angustifolium, (80).
Behringianum, 107.
Bongardi, 107.
boreale, 97.
brevistylum, 100, 102.
Californicum, 96.
Chilense, (95).
ciliatum, (94).
clavatum, 111.
coloratum, 92, (94).
Davuricum, 90.
delicatum, 98.
densum, (88).
Drummondii, 100, 102.
exaltatum, (95).
Fendleri, 92.
Franciscanum, 90, 95.
glaberrimum, 100, 104.
glandulosum, 99, (102).
glaucum, (105).
Halleanum, 101, 102.
hirsutum, 82.
holosericeum, 91.
Hornemanni, 104, 105, 108, 111.
hybrids, 70, 89, 95, 105, 107.
jucundum, (86).
lactiflorum, (108).
latifolium, 81.
leptocarpum, 103.
lineare, 87.
luteum, 82.
Mexicanum, 97.
minutum, 86.
molle, (87).
Novo-Mexicanum, 93, 95.
obcordatum, 83.
oliganthum, (88).
Oreganum, (105).
Oregonense, 109.
palustre, 88, 94.
paniculatum, 71, 85.
Parishii, 97.
parviflorum, 82.
pruinosum, (104).
pseudo-lineare, 89.
pseudo-scaposum, 111.
pubescens, (82).
rigidum, 83.
saximontanum, 99, 102.
spicatum, 80.
strictum, 87.
suffruticosum, 84.
tenellum, (94).
tetragonum, (92, 94).
ursinum, 100.
Watsoni, 91.

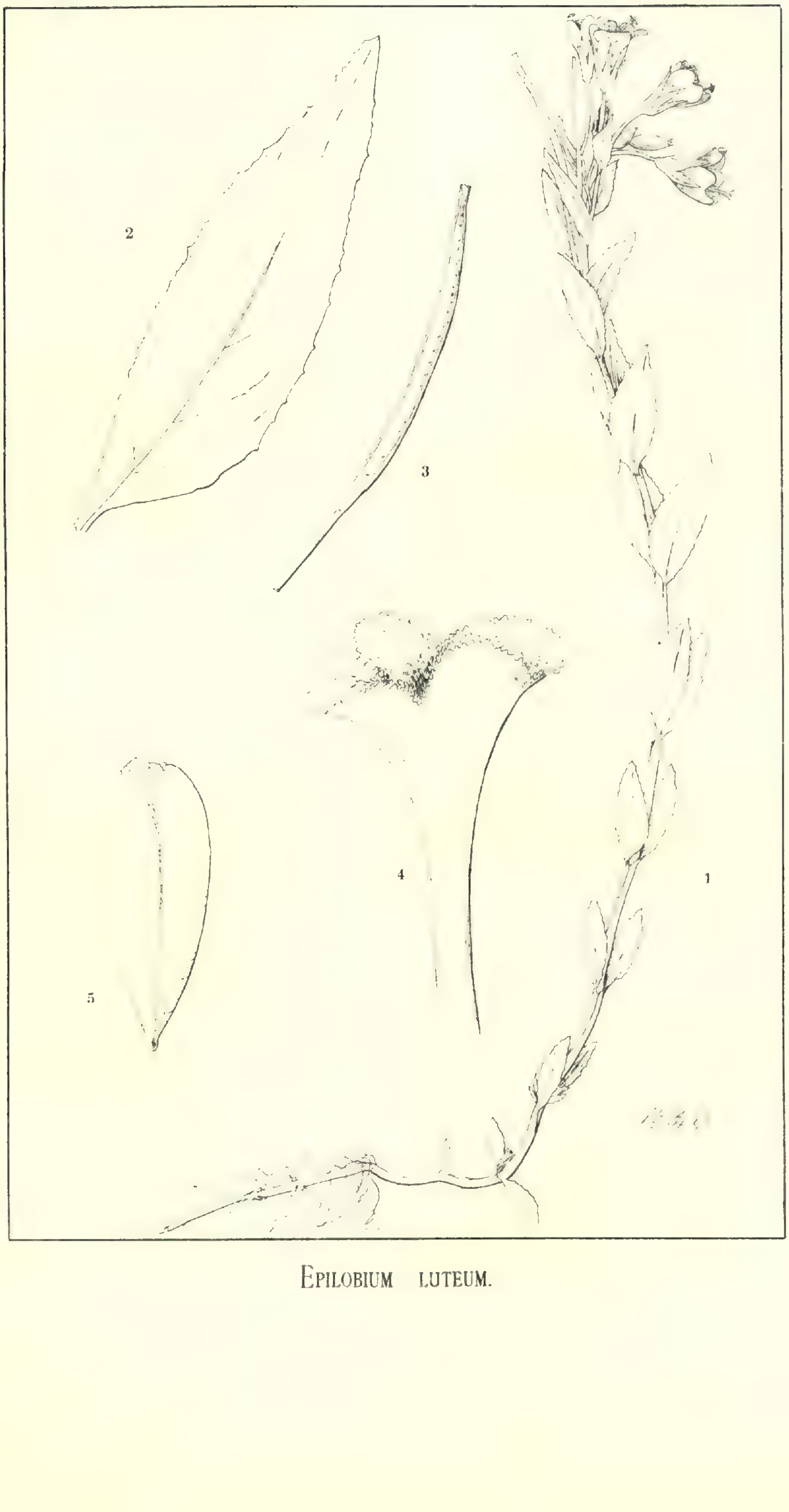
PRESS OF NIXON-JONES PRINTING CO.

EPILOBIUM SPICATUM.



EPILOBIUM LATIFOLIUM.

EPILOBIUM HIRSUTUM.

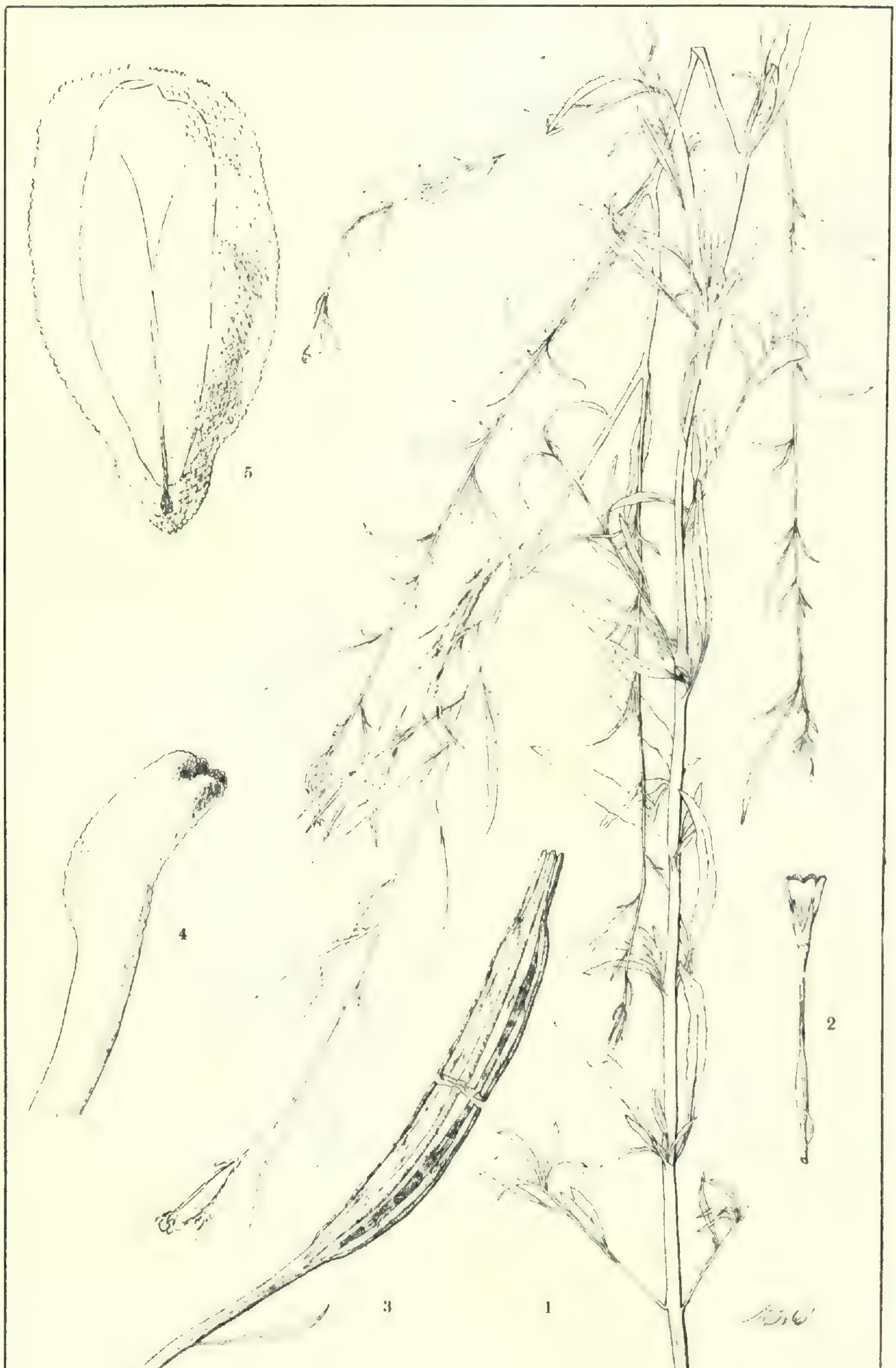


EPILOBIUM LUTEUM.

EPILOBIUM RIGIDUM.

EPILOBIUM OBCORDATUM.

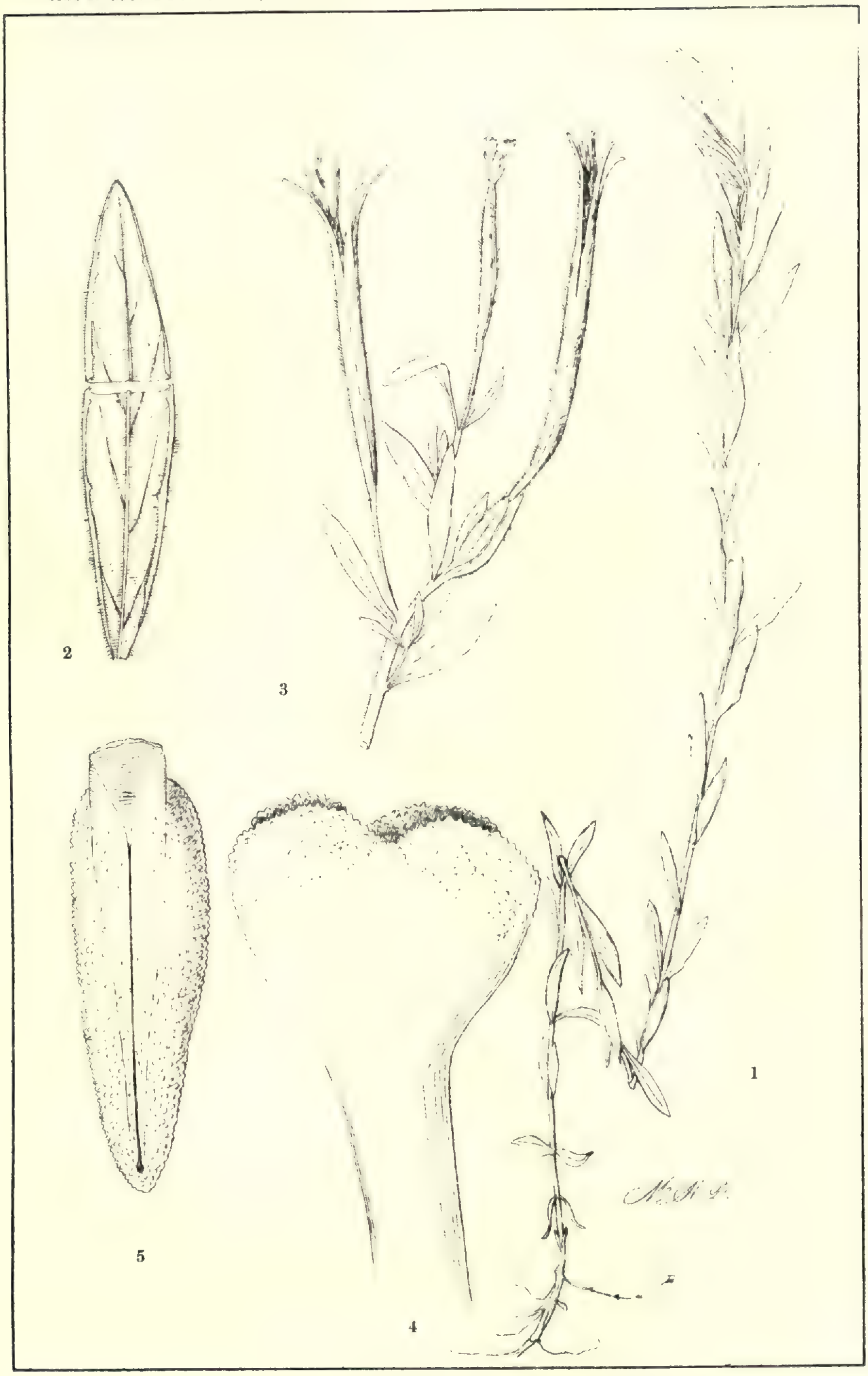
EPILOBIUM SUFFRUTICOSUM



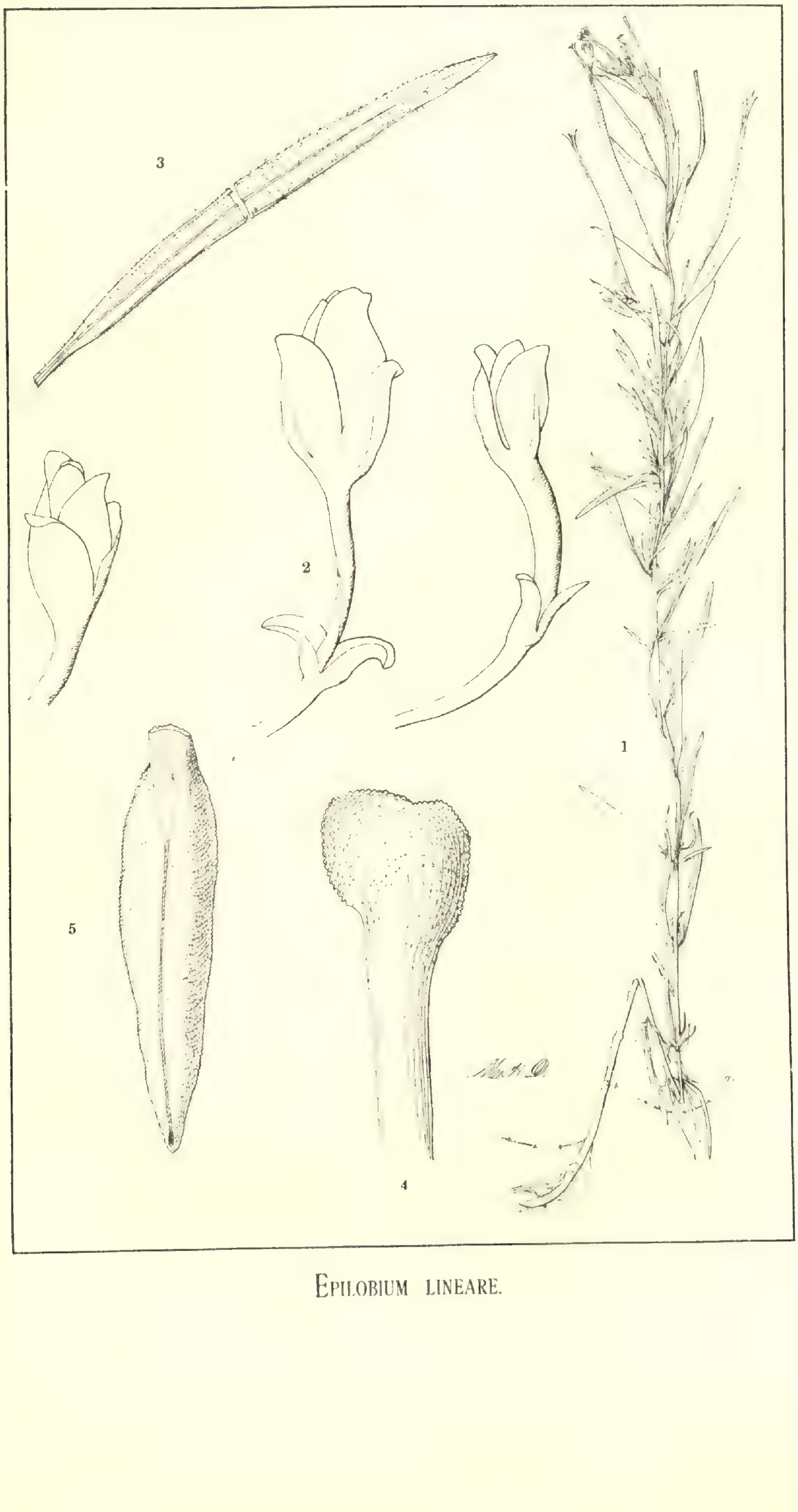
EPILOBIUM PANICULATUM.

EPILOBIUM PANICULATUM, var. JUCUNDUM.

EPILOBIUM MINUTUM

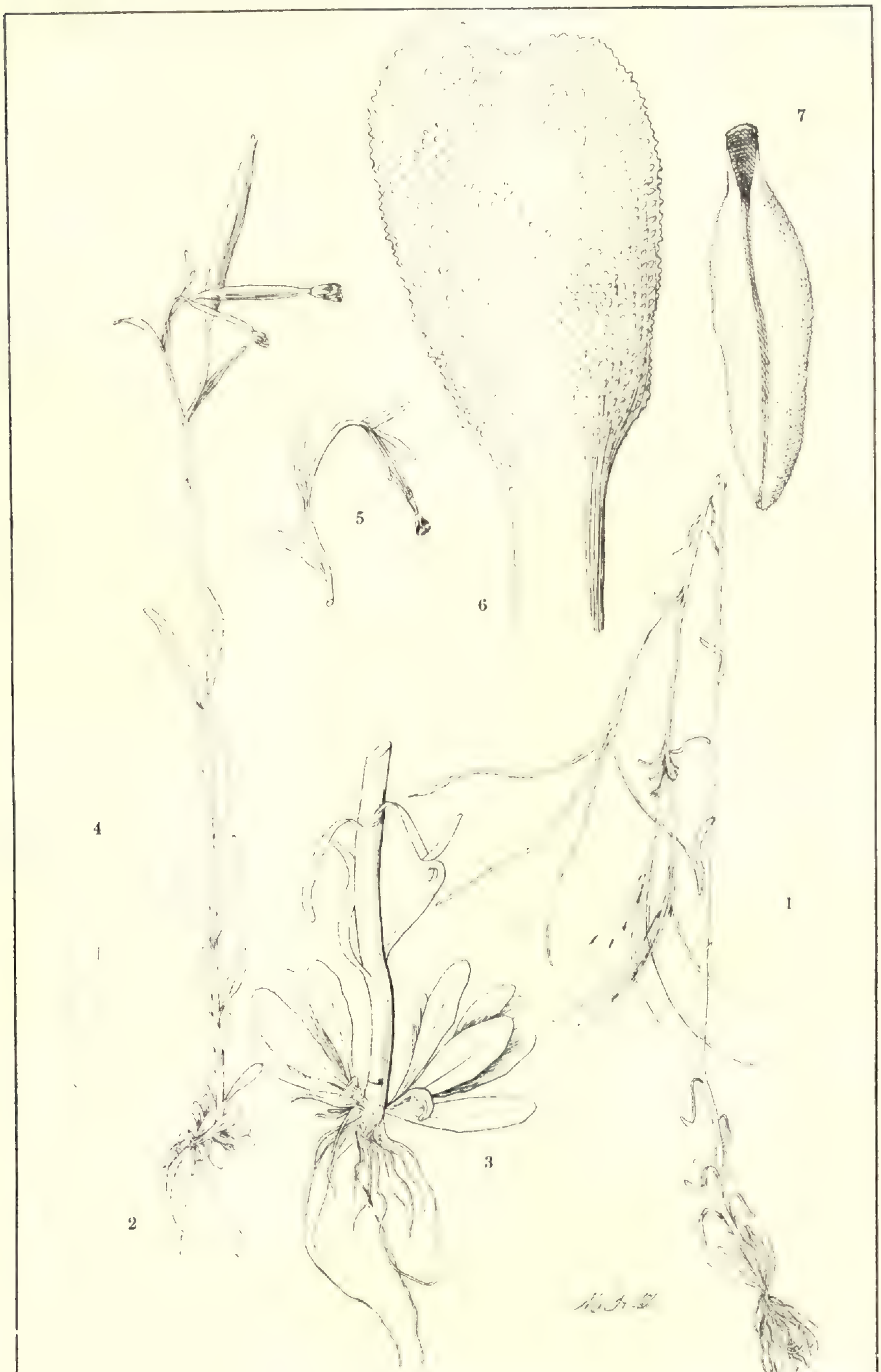


EPILOBIUM STRICTUM.

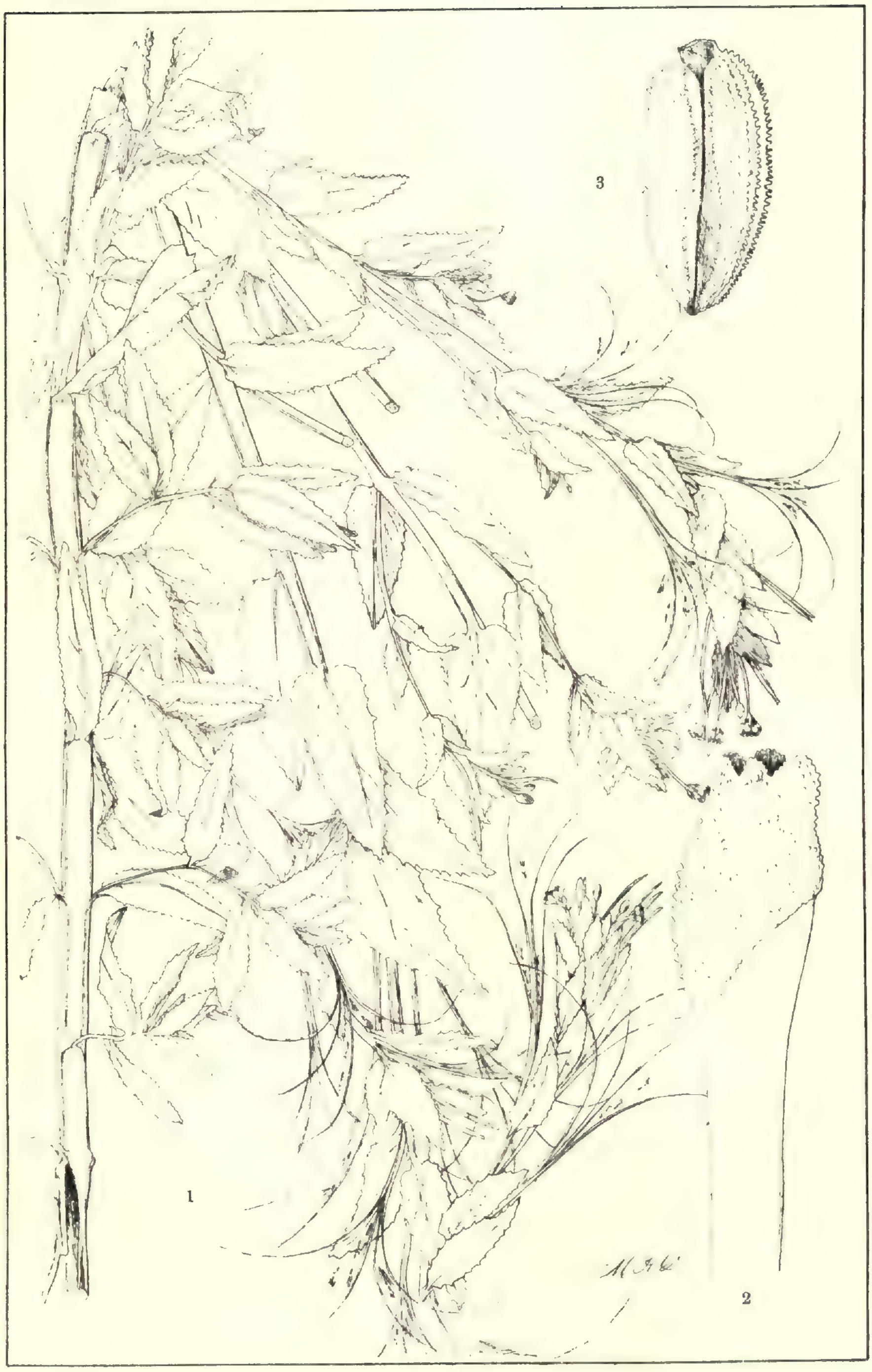


EPILOBIUM LINEARE.

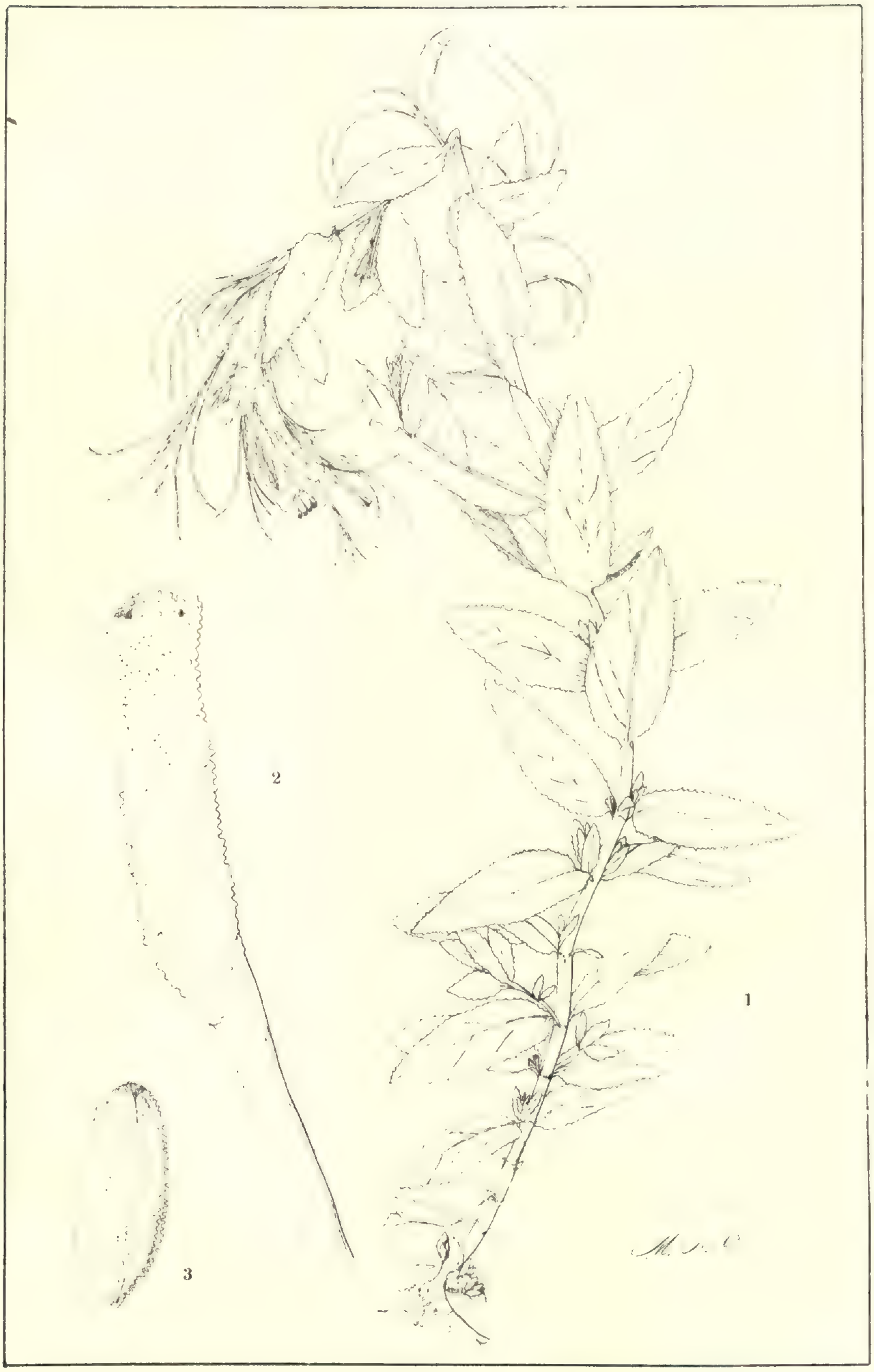
EPILOBIUM PALUSTRE.



EPILOBIUM DAVURICUM.



EPILOBIUM FRANCISCANUM.



EPILOBIUM WATSONI.

EPILOBIUM HOLOSERICEUM.

EPILOBIUM FENDLERI.

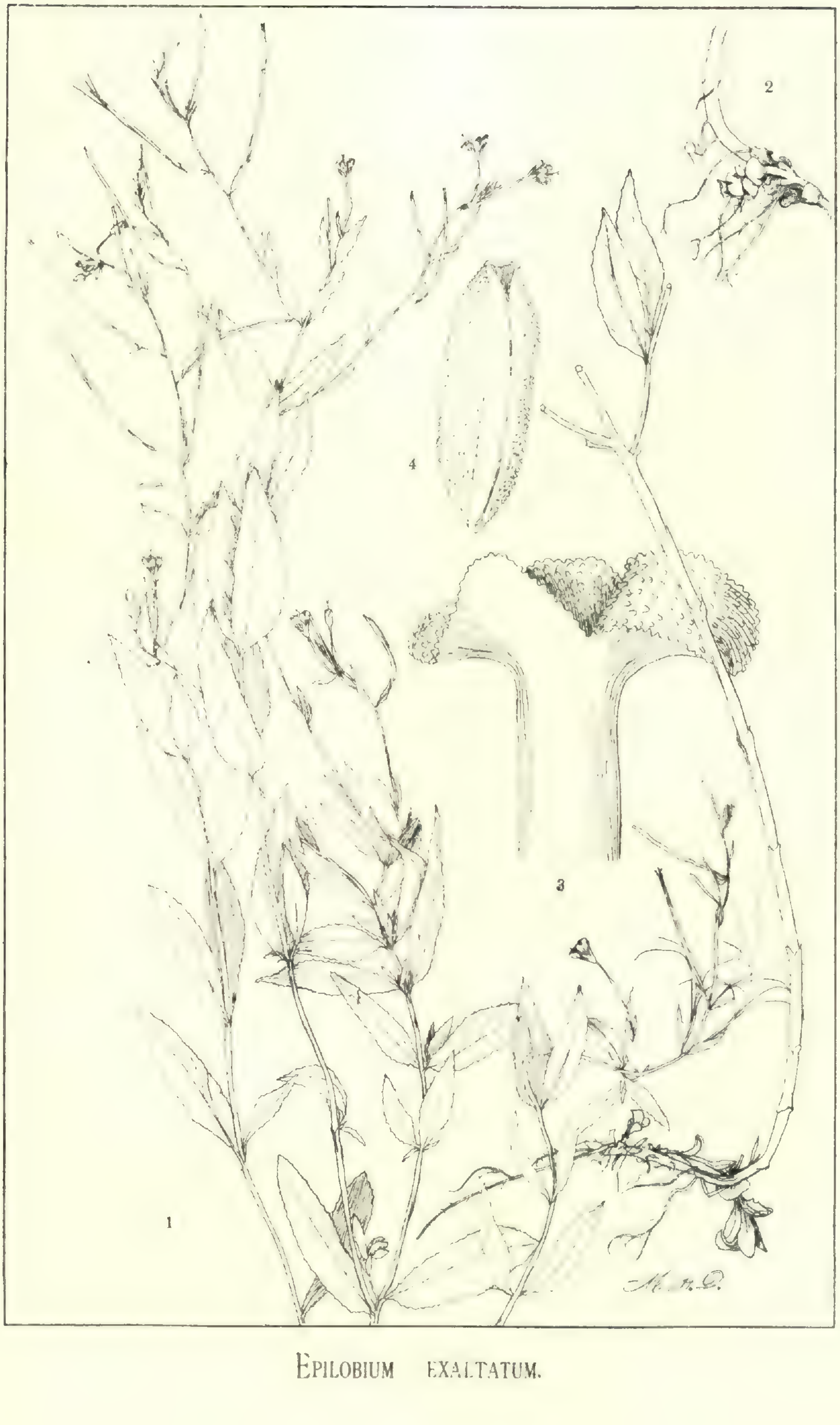
EPILOBIUM COLORATUM.

EPILOBIUM NOVO-MEXICANUM.

EPILOBIUM ADENOCAULON.

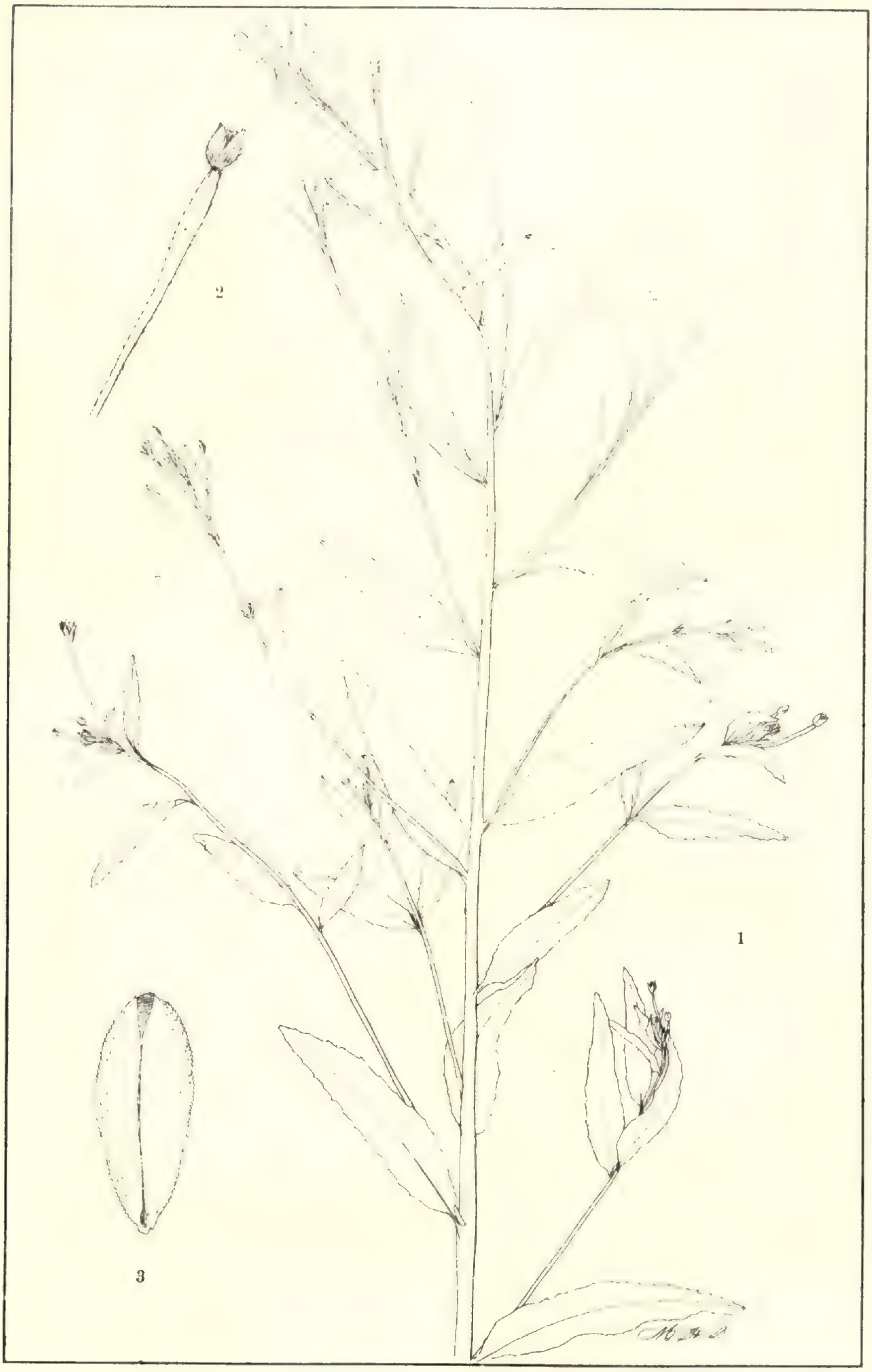
EPILOBIUM ADENOCAULON.

EPILOBIUM ADENOCAULON, var. OCCIDENTALE.



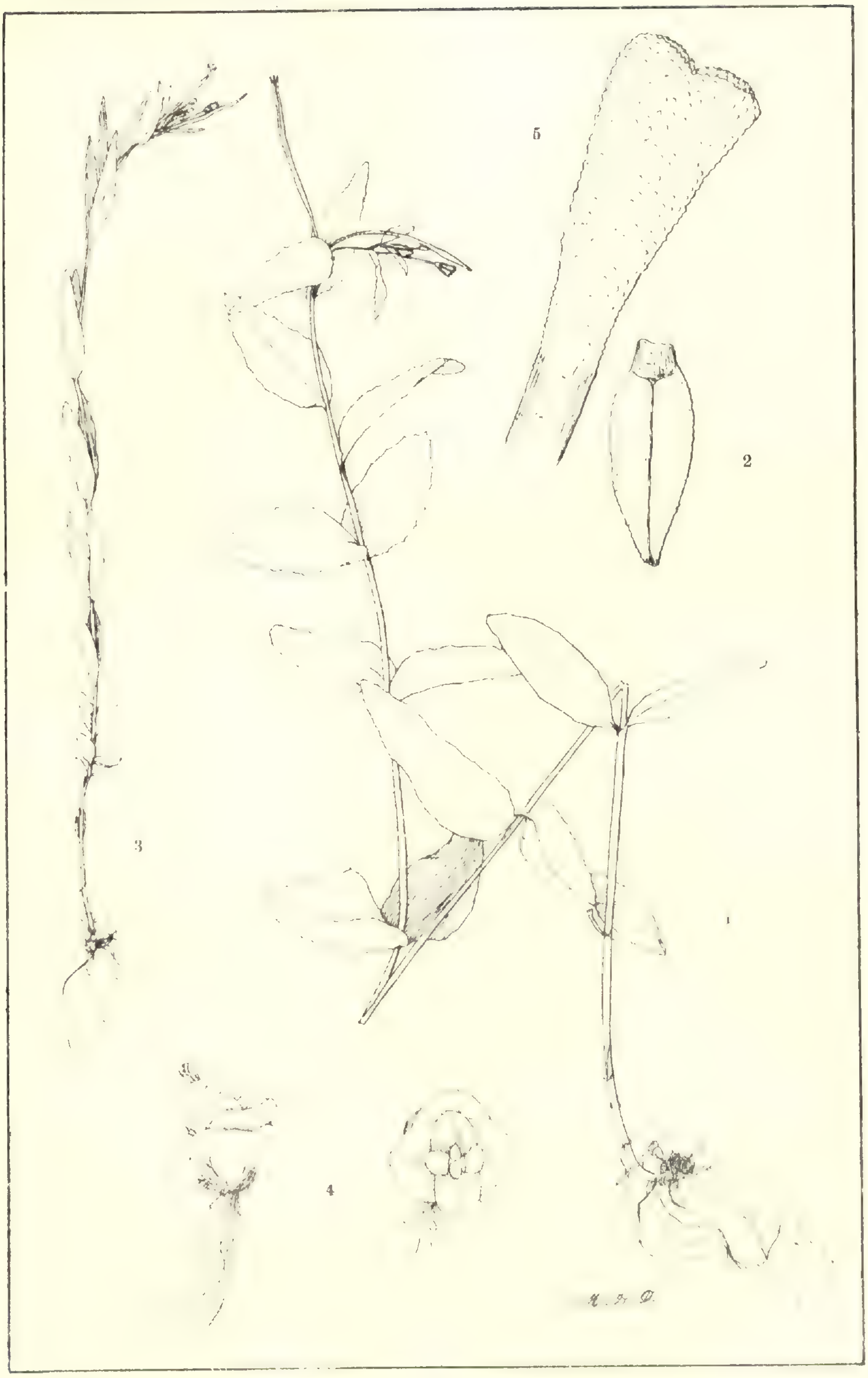
EPILOBIUM EXALTATUM.

EPILOBIUM ADENOCAULON, var. PERPLEXANS.



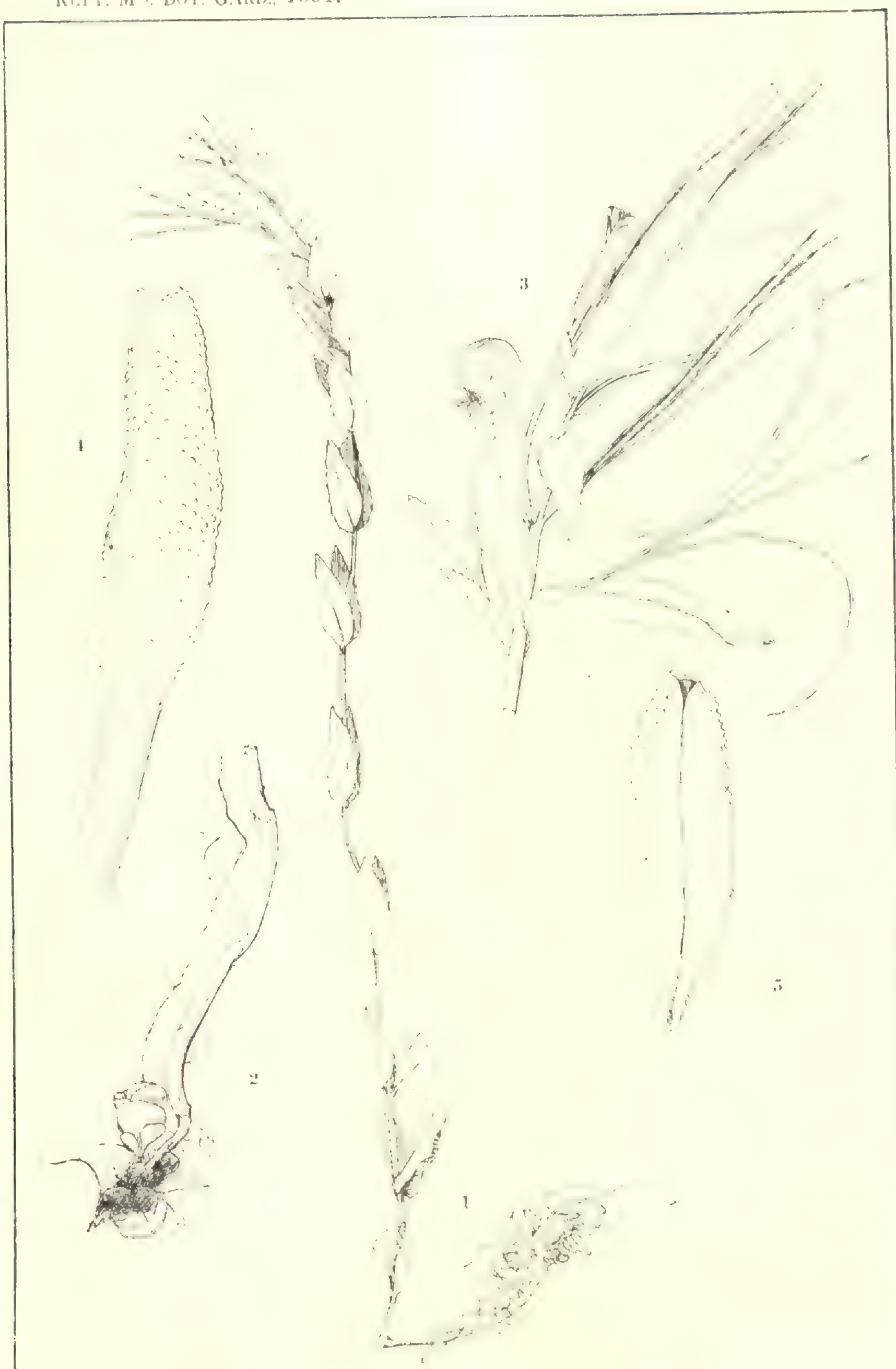
EPILOBIUM CALIFORNICUM.

EPILOBIUM PARISHII.



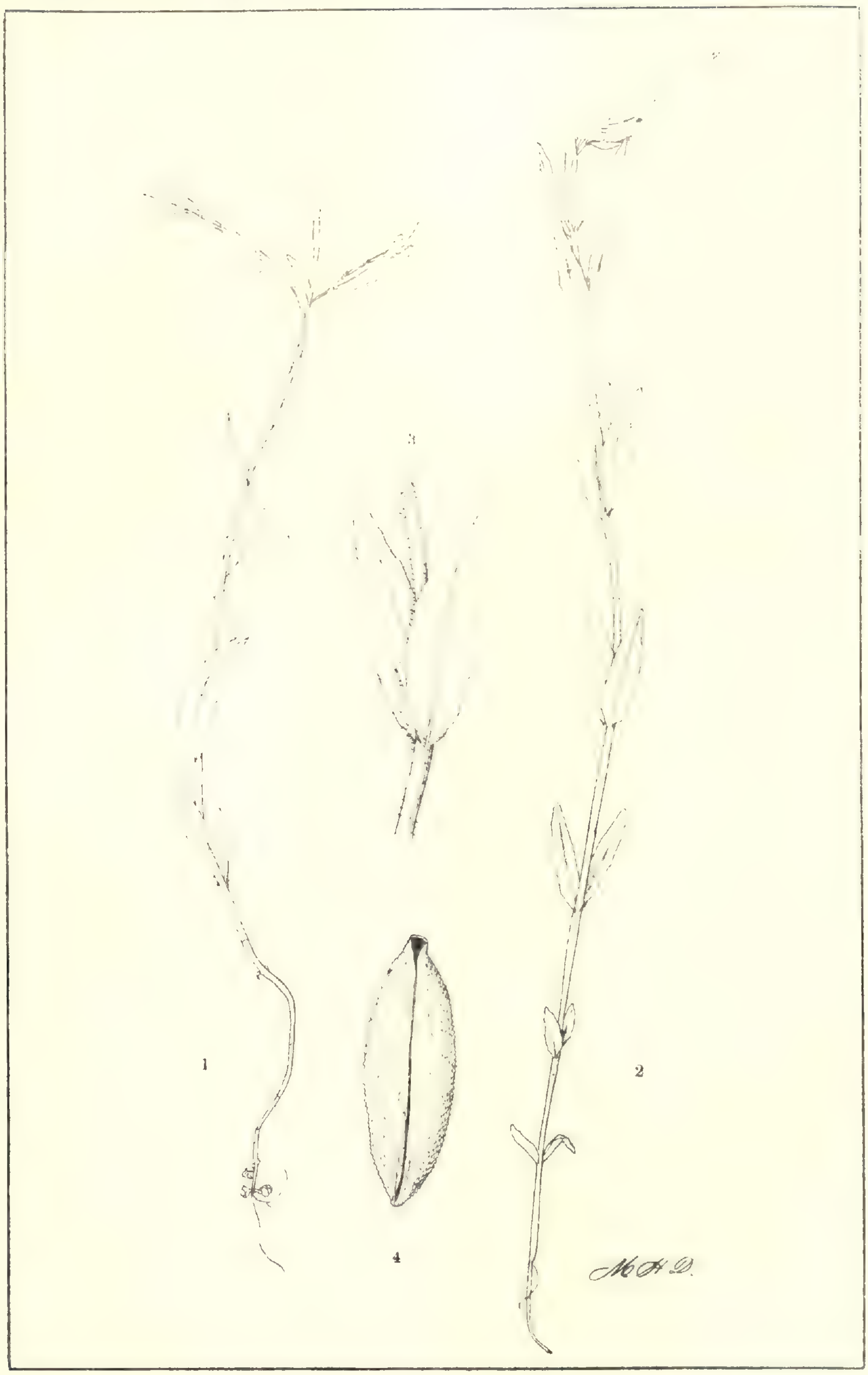
EPILOBIUM DELICATUM.

EPILOBIUM GLANDULOSUM.



EPILOBIUM BREVISTYLUM.

EPILOBIUM URSINUM.



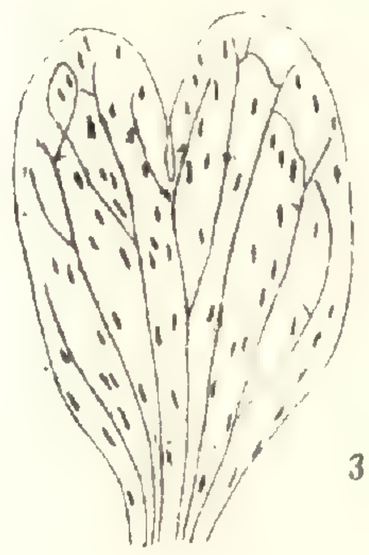
EPILOBIUM URSINUM, var. SUBFALCATUM.

EPILOBIUM HALLEANUM.

EPILOBIUM DRUMMONDII.

EPILOBIUM SAXIMONTANUM.

2



3

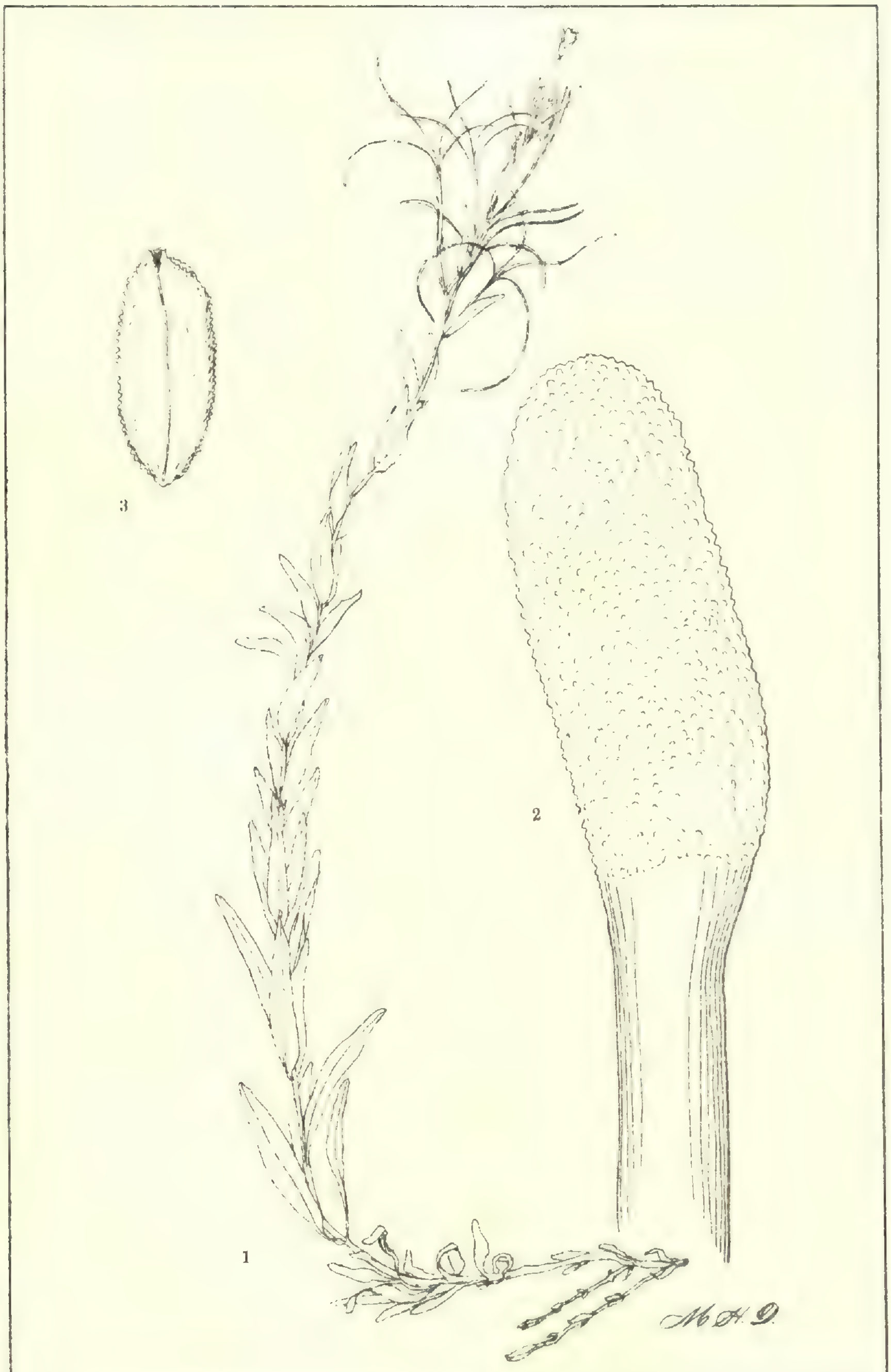
1

5

4

EPILOBIUM LEPTOCARPUM.

EPILOBIUM LEPTOCARPUM, var. MACOUNII.



EPILOBIUM GLABERRIMUM.

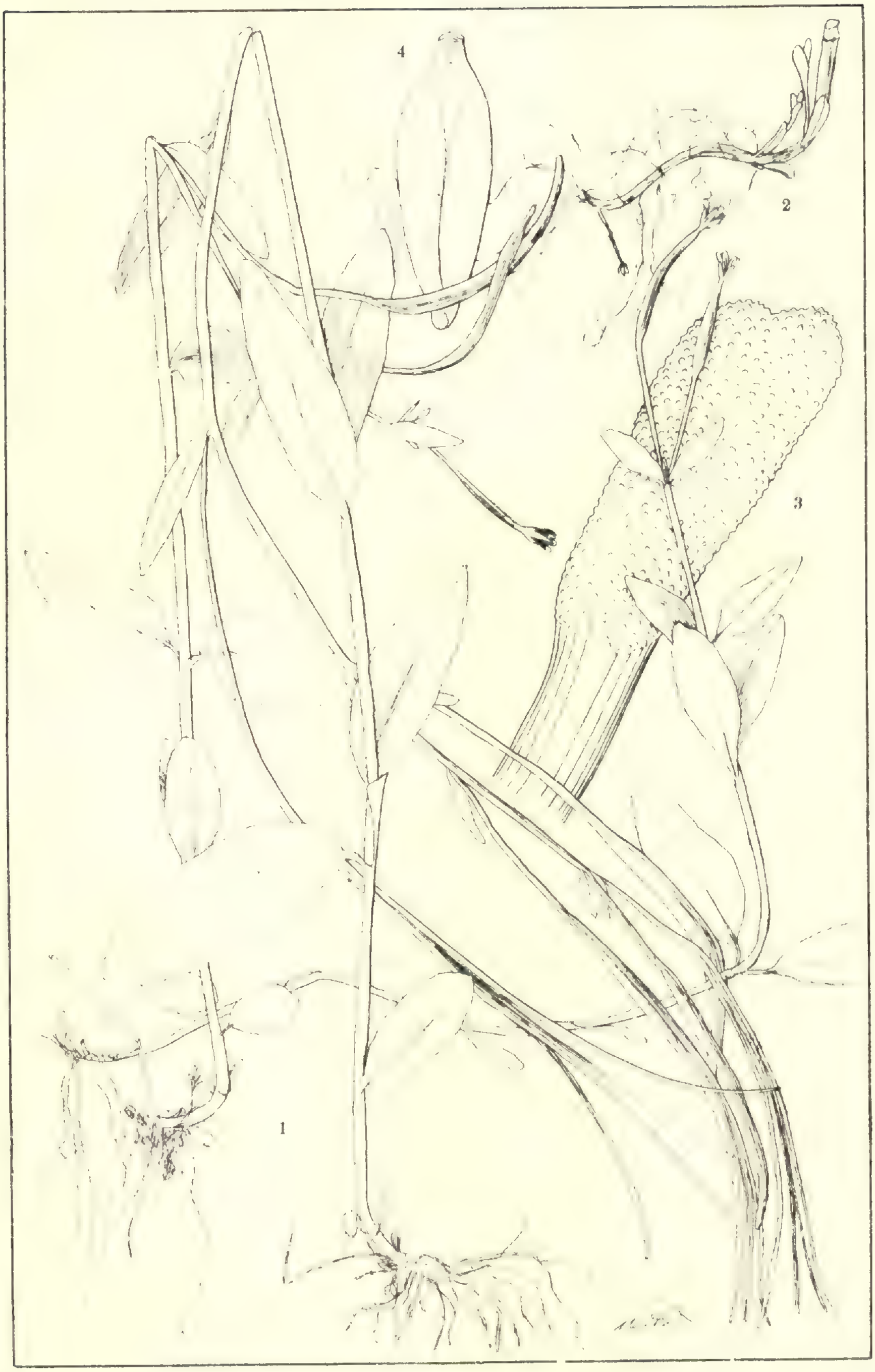
EPILOBIUM GLABERRIMUM, var. LATIFOLIUM.

EPILOBIUM OREGANUM.

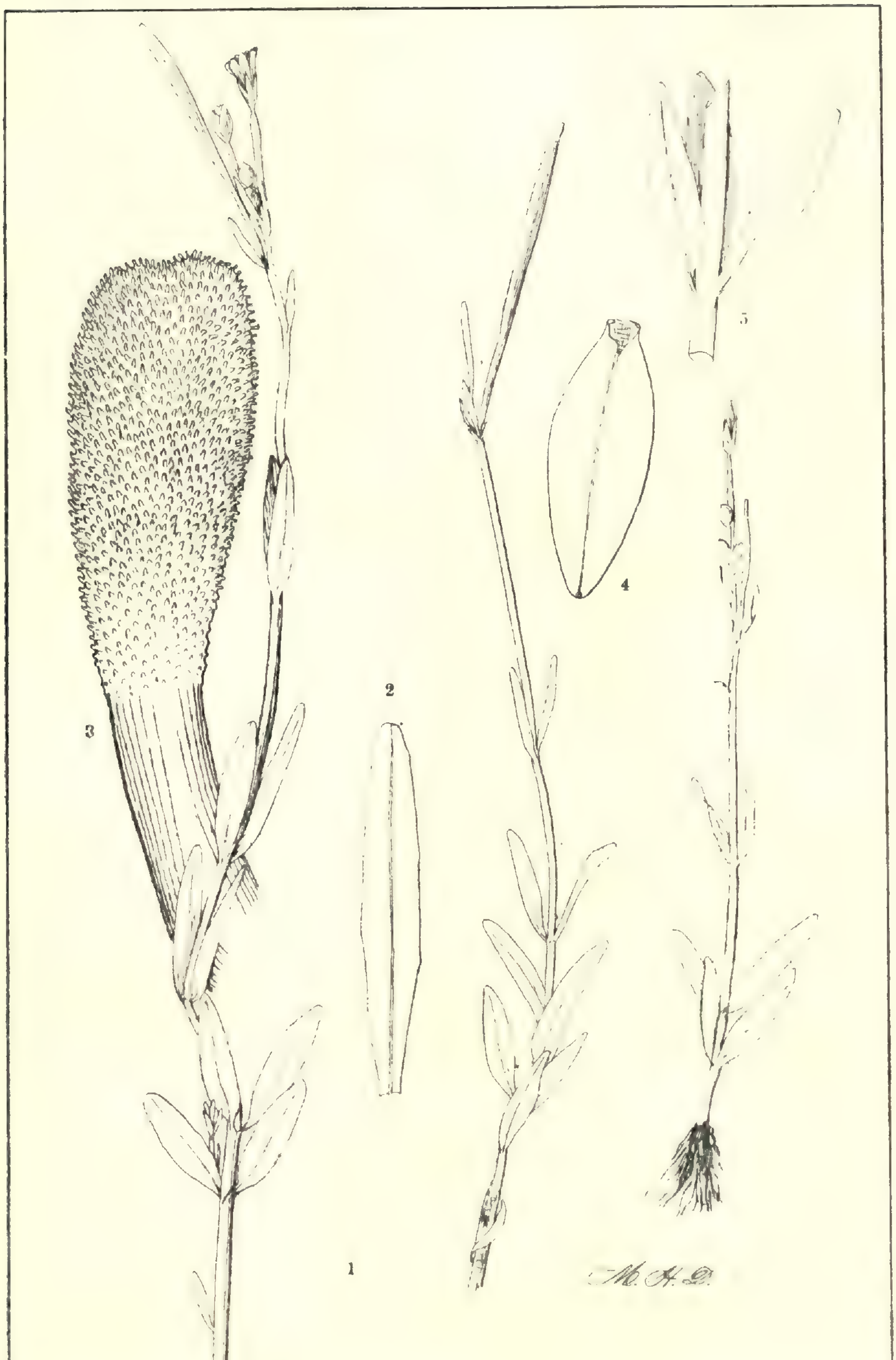
EPILOBIUM HORNEMANNI.

EPILOBIUM HORNEMANNI.

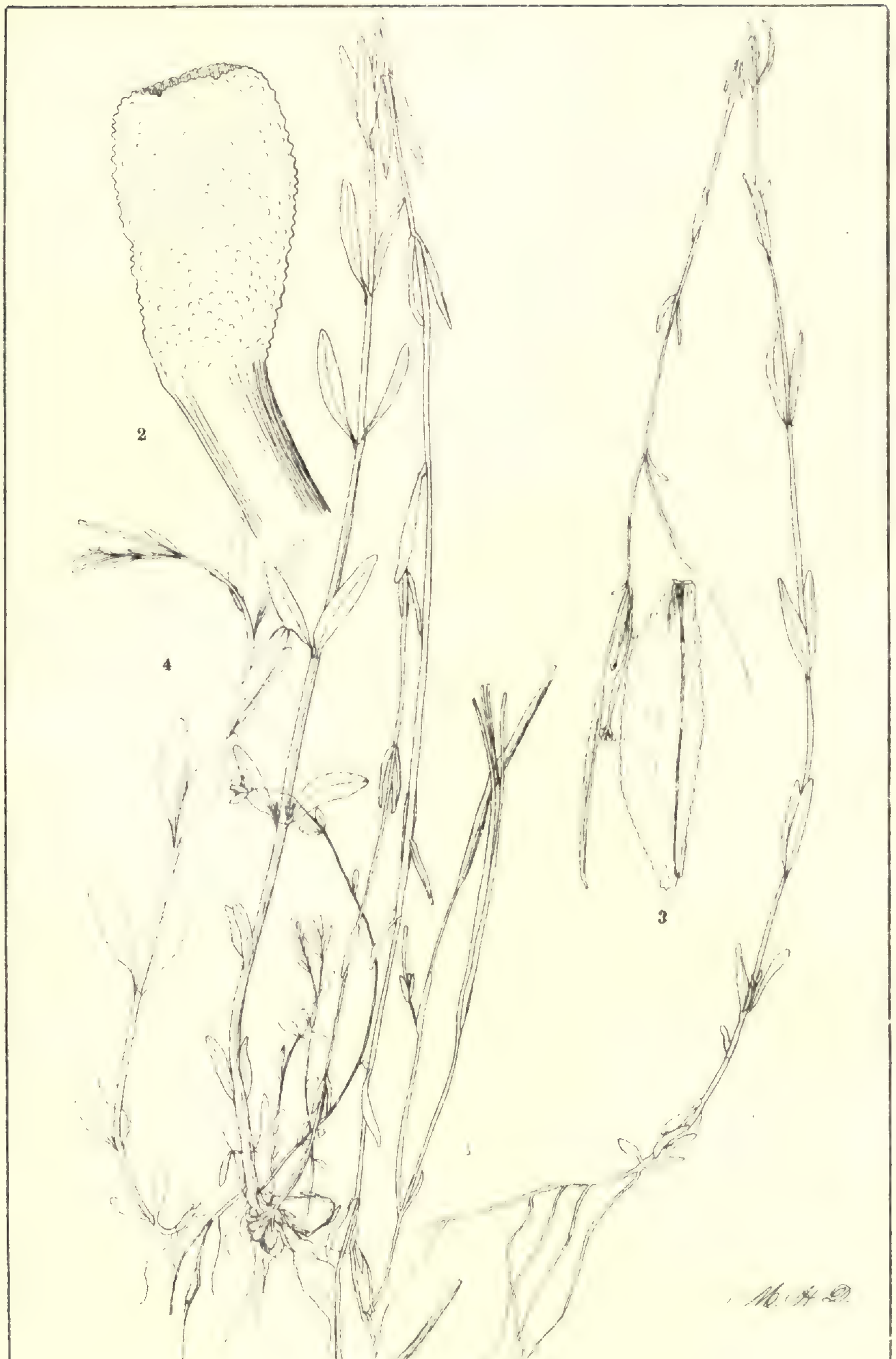
EPILOBIUM BONGARDI.



EPILOBIUM ALPINUM.



EPILOBIUM OREGONENSE.



EPILOBIUM OREGONENSE, var. GRACILLIMUM.

EPILOBIUM ANAGALLIDIFOLIUM.

EPILOBIUM CLAVATUM.

MAP OF THE GARDEN.

(Scale 1 inch to 60 feet).

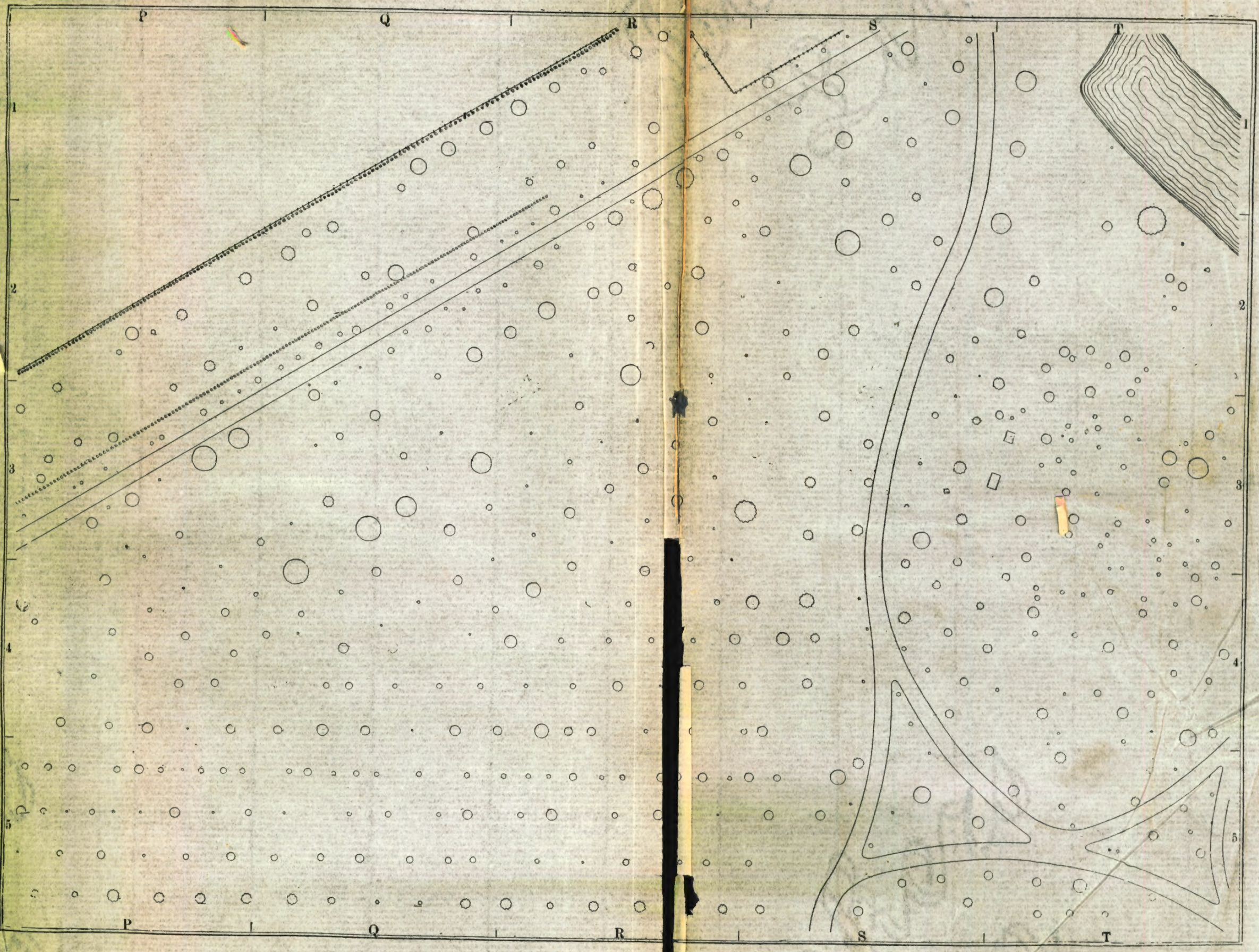
The following sheets, reduced from a portion of the Map by Johnson and Flad, constitute the first series of sheets above those reproduced in the preceding volume, and therefore represent the grounds immediately west of the portion mapped in the last volume, and extending from Magnolia Avenue (A), on the south, to Shaw Avenue (Z), on the north. The principal points of interest are located as follows:—

Bridges over Brook, V–W3, Y4.
Brook, U1 to Y4.
Evergreen Avenue,
L to 3, 3 to S.
Farm Yards, I to M, 1 to 4.
Gates between Garden and Arboretum, M6, S6.
Labyrinth, N–O5.
Pavilions, O5, V4–5, W–X2.
Willow Pond, T1 to U3.

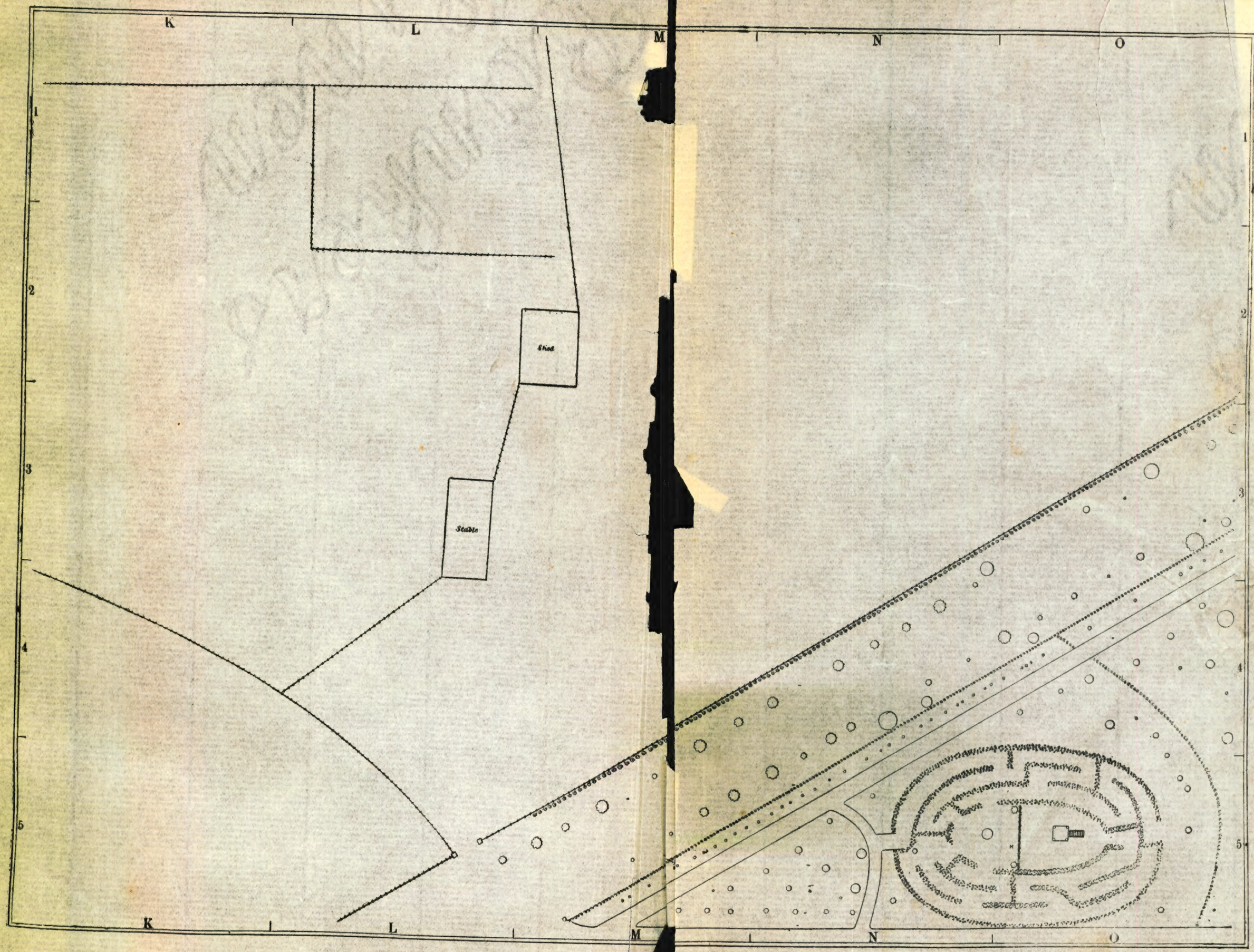
U V W X Y

1 2 3 4 5

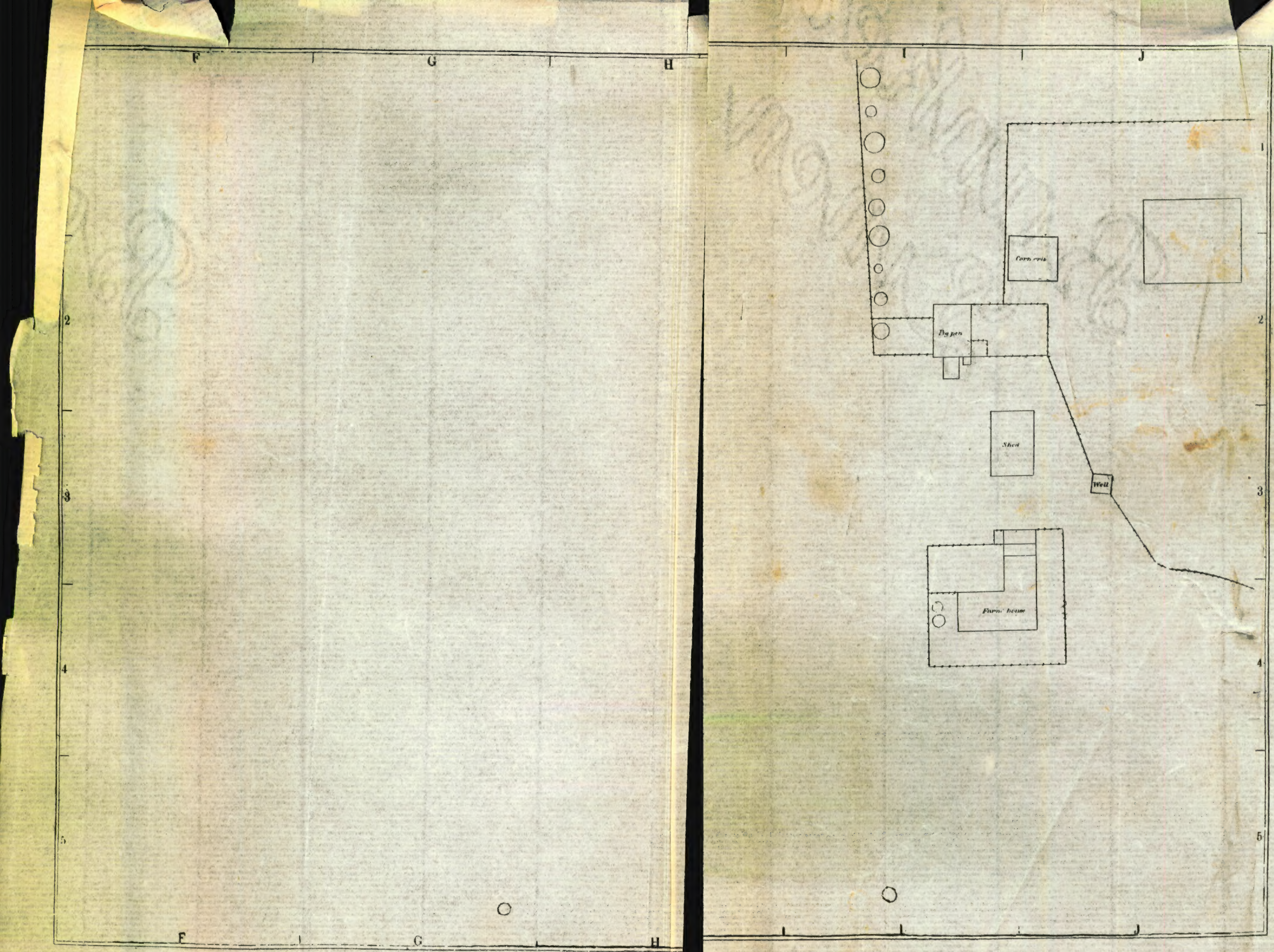
ARBORETUM



ARBORETUM.

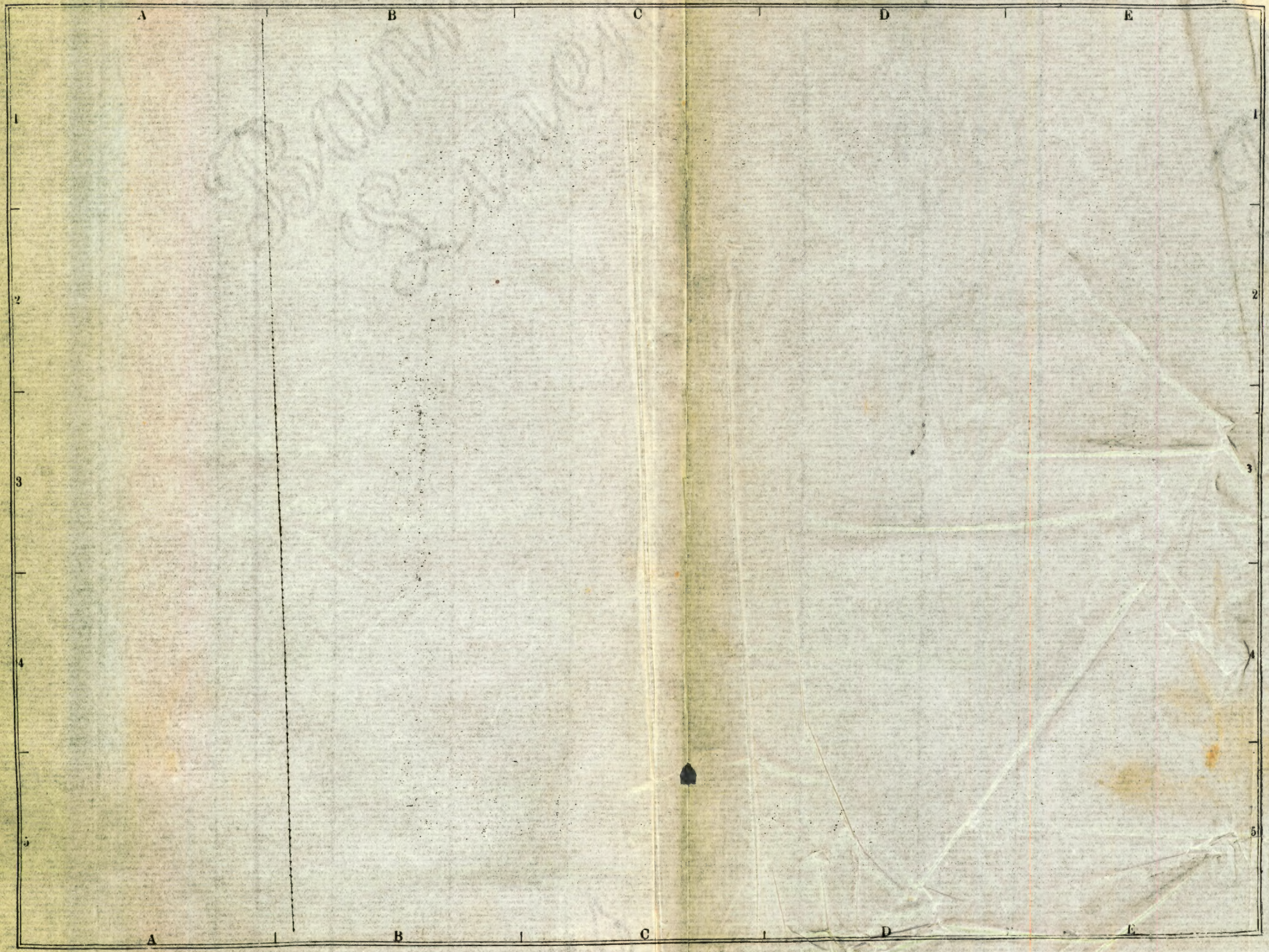


FARM ENCLOSURE, MEADO[illegible]ND ARBORETUM.



MEADOW, AND FAM

BUILDINGS.



MEADOW, LYING WEST OF THE LODGE.